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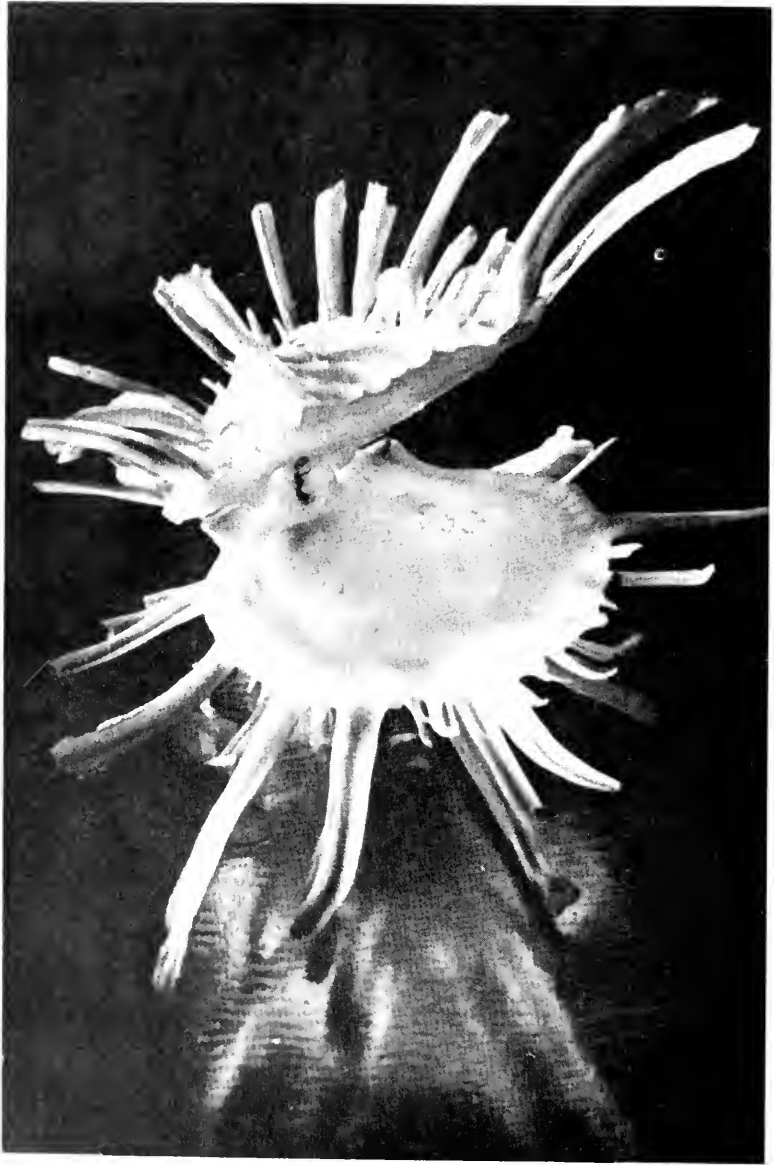
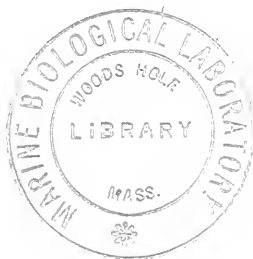


Photo by Ruth Bernhard

*Spondylus americanus* Hermann

**MARINE SHELLS  
OF THE  
WESTERN COAST  
OF  
FLORIDA**



By

LOUISE M. PERRY AND JEANNE S. SCHWENGEL

With Revisions and Additions to Louise M. Perry's  
Marine Shells of the Southwest Coast of Florida

Illustrations by W. Hammersley Southwick,  
Axel A. Olsson, and Frank White

March, 1955

PALEONTOLOGICAL RESEARCH INSTITUTION  
ITHACA, NEW YORK  
U. S. A.

MARINE SHELLS OF THE SOUTHWEST COAST OF FLORIDA  
printed as  
Bulletins of American Paleontology, vol. 26, No. 95  
First printing, 1940  
Second printing, 1942

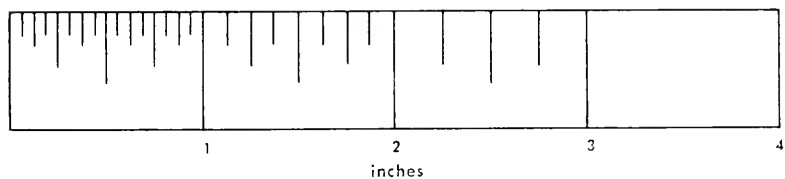
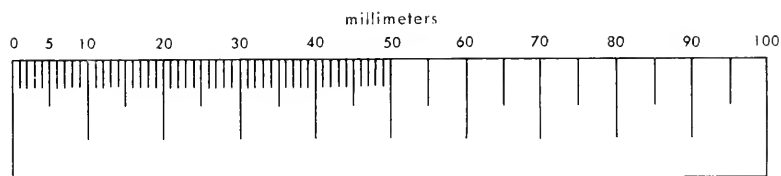
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*Library of Congress Catalog Card Number: 54-12005*

Printed in the United States of America

*It is perhaps a more fortunate destiny to have a taste  
for collecting shells than to be born a millionaire.*

Robert Louis Stevenson





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## PREFACE BY THE REVISER

It has been a privilege to revise Louise M. Perry's fine book on "Marine Shells of Southwest Florida", to include her studies on eggs and larvae of mollusks; and to add descriptions and illustrations of several newly discovered shells thus making it a more comprehensive study of the molluscan life of western Florida. The work that I have done is only a small return to Dr. Perry for the many hours of instruction that she has given to me for so fascinating an avocation. Part of the material, other than that of Dr. Perry's, upon which the descriptions in this book are based, is in my collection.

Sincere thanks are given to Harald A. Rehder, Joseph P. E. Morrison, R. Tucker Abbott, and Ruth Turner for help and advice; and especially to Henry A. Pilsbry and William J. Clench, who so generously gave of their valuable time to read the manuscript, which therefore, has been so materially improved by their suggestions and corrections.

Acknowledgment is made of the valuable information gleaned from the pages of the "Manual of Conchology," "The Nautilus," "Johnsonia," and "American Sea Shells". Venia T. Phillips and Maurice E. Phillips of the Academy of Natural Sciences kindly verified obscure references.

My thanks are extended to Margaret Storey for permission to photograph her beautiful drawings of the eggs, egg capsules, and larvae; to Katherine V. W. Palmer for the use of photographs of egg capsules and for her help and advice in this revision; also to Marie Lebour, for the descriptions of eggs and larvae, which I have quoted.

I am grateful to Axel Olsson and Frank White, who photographed the shells and made the illustrations which have been added to this study, and to my husband, Frank R. Schwengel, for his helpfulness and encouragement.

Scarsdale, New York

March 5, 1954

Jeanne S. Schwengel



## FOREWORD

This new and revised edition of Dr. Louise M. Perry's "Marine Shells of the Southwest Coast of Florida" will mark another milestone in our knowledge of Western Atlantic mollusks. The edition in 1940 was the first serious attempt to monograph a small regional area south of the State of New York. This newly revised edition by Dr. Perry and Dr. Jeanne S. Schwengel, not only adds several more species to this record, but in addition, much detail on the early life histories of many species. This is exceedingly important. We still know little regarding our mollusks other than that they exist. The task of finding life history data is not easy, and it calls for prolonged study in the field. Casual collecting can add a few details, but only continuity of observation can chain the facts together.

I can recall vividly the day I spent with Dr. Perry in her little laboratory on Sanibel Island. This was many years ago. As fast as she could locate "live egg cases", they were added to her aquaria, and when the young hatched they were drawn and notes made on their development until they were large enough to be identified with a known species. Dr. Schwengel has screened this large mass of data and added all that were conclusive to the species in this area.

Cambridge, Mass.  
March, 1954

William J. Clench,  
Curator of Mollusks,  
Museum of Comparative Zoölogy,  
Harvard University



## INTRODUCTION

Some fifth of a century ago when I first saw a Florida beach, with its multitudes of shells they seemed worthy of attention only as adding variety to the general attraction of the seashore; but within a few tides times the lion's paw, the angel's wing, the fighting conch and the calico shell had acquired individuality and stimulated an interest that must enrich any experience which includes them.

The abundance and variety of southern Florida's molluscan fauna is unexcelled by any other in America, and by but few areas of like extent anywhere. This circumstance is due to a combination of ecological factors related to latitude, sufficient bathymetric range for slight differences of water temperature, characters of sea bottom, and some local modifications of salinity due to drainage of fresh water from the Okeechobee basin and other areas. The littoral region has many general characteristics of sand, mud and weedy bottom. Oyster-bars, sandbars and mangrove flats, and in deeper water, rock and coral reefs and outcroppings of hardpan have their peculiar associations of mollusks and other marine animals. Species native to a more southerly province overlap some which have a more northerly range, and some genera common on the southern Atlantic Coast are established along the Gulf Coast without continuity of any of their species around the southern tip of the Florida Peninsula.

All descriptions apply to specimens which were taken alive or in such fresh and perfect conditions that a local station may reasonably be assumed. All measurements refer to average sizes, adult shells, and all illustrations are of recently collected specimens.

The study collection upon which the descriptions are based has been placed in the Thomas R. Baker Museum at Winter Park, Florida.

The 'List of Marine Mollusca from Labrador to Texas', by Charles W. Johnson (Boston, 1934) is used as the basis of classification and nomenclature. Free use has been made of available conchological literature.

Acknowledgment of valuable assistance is made with pleasure to Dr. Henry A. Pilsbry, to Dr. Paul Bartsch, to Dr. Harald A. Rehder, to Richard F. McLean and Jeanne S. Schwengel. Thanks are due to George W. Underhill and George W. Underhill, Jr. for skillful use of boats and dredges.

Dr. Eugene W. Gudger has been kind enough to read the manuscript and offer many helpful suggestions.

L. M. P.

Sanibel Island, Florida.

[1940]

## GENERALIA

Shelled mollusks belong to one of the most ancient groups of animal life. Five hundred million years ago there lived in the Cambrian period of the earth's geologic history snails with shells so complex and perfect that their presence can be explained only by the existence of ancestral forms in a period far more distant. These fossil remains are of great importance in the study and chronological interpretation of the earth's geologic past. Their presence in stratified rocks determines the periods in which successive layers of sediment were deposited in ancient seas, and the evolution of primitive molluscan shells may be traced through these sedimentary deposits to the shells of Recent families and genera. Certain shells from Tertiary deposits in the Okeechobee and Caloosahatchee basins are of types which persist in the living molluscan fauna of Florida waters.

Emanuel Mendes da Costa,<sup>1</sup> 178 years ago wrote:—

The study of Shells, or testaceous animals, is a branch of Natural History, though not greatly useful in human oeconomy, yet perhaps, by the infinite beauties of the subjects it treats of, is adapted to recreate the senses, and insensibly to lead the amazed admirer into the contemplation of the glory of the Divinity, in their creation.

The British conchologist George Perry, expressed a like feeling in the introduction of his "Conchology, or the Natural History of Shells", published at London in 1811. The sentiment was not unique, for the symmetry and beauty of shells have suggested many forms in art and architecture, and in some parts of the world their use as objects of utility, ornament and symbolism is presently continuous with the practice of early man. North American Indian tribes which practiced totemism used shells (*Cypraea moneta*) in their ritual of death and resurrection, and so recently as eighteen forty-eight to the eighties, Maplewood Institute for Young Ladies, at Pittsfield, Massachusetts, listed Conchology in its regular curriculum as a subject of cultural value to its students.

Certain elementary principles must be understood before an intelligent approach can be made to the study of shells. It is a matter of common knowledge that animals differ widely in appear-

<sup>1</sup> Elements of Conchology, 1776

ance and anatomical structure. These differences form the basis of classification of all animal forms—first into two principal groups—invertebrates and vertebrates, or those forms without a backbone and those possessing one. These groups are divided into phyla (Gr., *phylon*, meaning race or tribe). Each phylum is subdivided on the basis of anatomical structure into groups which show the increasingly closer relationships which establish class, order, family, genus, and species.

The phylum Mollusca (Lat., *mollis*, soft, having reference to the soft body) is fifteenth on the scale of increasing complexity of structure among the invertebrates. It has perhaps, more than 100,000 species, a greater number than any other group of animals excepting the Arthropoda which includes the insects and crustaceans.

Mollusks have no supporting skeleton, but with few exceptions they have developed a protective calcareous structure, the shell<sup>2</sup>, which has evolved into a number of highly differentiated forms. The shell is a part of the animal, and failure to consider this relationship and the relationship of mollusks to other animal species, deprives the student of one of the great advantages and pleasures of his avocation.

The shell is secreted by a specialized part of the mollusk's body called the mantle, which envelops the soft structures like a closely wrapped cape, and whose external, secreting surface is in intimate contact with the internal surface of the shell. The secreted shell substance consists of about five per cent of an organic matrix called conchyolin impregnated with mineral salts taken from the sea water, principally carbonate of lime and small amounts of magnesium. The conchyolin, which is elaborated and secreted by the mantle, provides a framework for deposition of the mineral salts, and in an unimpregnated state forms an external covering for the shell which affords protection against chemical injury from corrosive substances which the water may hold in solution; it is called the epidermis or periostracum. Differences in structural arrangement of the shell

<sup>2</sup> Dr. Samuel Johnson's Dictionary gives eight meanings for the word "shell". The second is "The covering of a testaceous or crustaceous animal". The word is of Saxon origin—scyll or scell—meaning rough, homespun.



elements produce differences in quality and appearance of the shells—viz. opaque, porcelanous, polished.

A rudimentary shell is present when the young mollusk leaves the egg capsule, or is developed soon thereafter. This nucleus rapidly increases its size by the addition of new shelly matter but is generally lacking in features which characterize older shells. Sculpture is formed and color and pattern are added by the secreting edge of the mantle, and any injury to this soft organ may result in some deformity of the shell and partial loss of pattern and color. Alternating periods of growth and inactivity are often defined by an axial ridge or varix which represents the outer lip of a previous aperture in univalve shells, and in lines or ridges of growth parallel to the margin of bivalve shells. All irregularities about the apertures and markings of shells are produced by corresponding irregularities in the edge of the mantle, and remain as sculptural features of the shell as new growth proceeds. Immature shells often differ from adult specimens of the same species; juvenile shells are usually thin, have thin lips and are lacking in the color and finished sculpture that ornament the adult shell. These differences are sometimes so marked that the identity of young shells has been unrecognized and independent specific rank given them.

Actual attachment of the mollusk to its shell is effected by means of strong muscles. In gasteropods, one powerful muscle is firmly fixed to the columella near the apex of the shell; in the pelecypods one or two muscles are attached at opposite points in the two valves. Contraction of these muscles keeps the valves tightly closed.

Color is present only on the surface of shells and is believed to be influenced by food and exposure to light. Shells from warm and shallow waters are usually more brightly colored than shells of species inhabiting the colder depths, and in most fixed bivalves the upper, exposed valve is the more highly colored.

Mollusks have well-developed systems for nutrition, respiration, circulation, excretion, and reproduction—all under the control of a nervous system. Many of them have organs of special sense; in some instances even a structure analogous to the ear, which keeps the animal in touch with its surroundings and aids in maintaining its equilibrium. Many mollusks are sensitive to light and respond actively to any change in its intensity; some possess compound eyes

with structures definitely comparable to those of the eyes of higher vertebrates.

Dr. Paul Bartsch, of the U. S. National Museum, claims for the Mollusca first rank in complex organization and intelligence among the invertebrates, and in consideration of the squid and octopus, believes that they surpass some groups of the lower vertebrates.

The food habits of mollusks are varied. Some gasteropods are predatory and carnivorous, others are vegetarian; some are parasitic on starfish, sea cucumbers, corals, sponges, and on other mollusks; some pierce the egg capsules of their own and other species to prey upon the contained ova and embryos. The food of the pelecypods consists of minute plants and animals taken into the digestive tract with indrawn currents of water.

In some groups of mollusks the sexes are separate, in which case the male is usually the smaller. In other groups the mollusks are bisexual, and there are some examples of true hermaphroditism.

Phosphorescence is a property of certain mollusks. The Roman naturalist Pliny remarked this emission of light, and wrote of the *Dactylus* (pholads), "it is the property of these fish to shine brightly in the dark, when all other lights are removed, and the more moisture they have, the brighter is the light they emit. In the mouth even, when they are being eaten, they give forth their light and the same too when in the hands; the very drops, in fact, that fall from them on the ground or on the clothes, are of the same nature. Hence it is beyond a doubt, that it is liquid that possesses this peculiar property, which even in a solid body, would be ground for considerable surprise".<sup>3</sup>

There is little definite knowledge of the age attained by mollusks. The great size of some gasteropods presupposes many years of life, and the enormous valves of the East Indian *Tridacna* are the growth of man's three score years and ten, and more. Some of the pelecypods reach reproductive maturity within 12 months, and oysters are known to live for 15 years.

The phylum Mollusca is divided into five classes:—Amphineura, Pelecypoda, Scaphopoda, Gasteropoda, Cephalopoda. Further sub-

<sup>3</sup> Historia Naturalis, Book IX, Chapter 33.

division expands each class through order and family, to genus and species. Shells of genera belonging to the Amphineura, Pelecypoda, Scaphopoda, and Gasteropoda are considered in this manual.

The system of scientific nomenclature in general usage is binominal. Latin or Greek words are generally used for generic and specific names. Occasionally proper names, names of localities, or words from a language other than Greek or Latin are chosen but are always given in Latinized form.

Each genus possesses a distinctive name, always capitalized—viz. *Oliva*. The name of a species consists of the name of its genus, followed by its own distinguishing name, both in italics; next is appended the name of its author whose original published description or definition clearly established the species,—viz. *Oliva sayana* Ravenel. Variations of a species sufficiently well defined and constant to merit subspecific distinction are given a third name which is interpolated between the specific name and the name of the sponsor,—viz. *Oliva sayana citrina* Johnson.

An often used form of typography in connection with the writing of scientific names is employed herein. If the generic name has been changed from that of the original, parentheses are placed around the author's name, e.g., *Crassostrea virginica* (Gmelin) [p. 43]. Such form indicates that Gmelin did not designate his species, *Crassostrea*, and one would not look in his work for the species under that generic name. In the case of *Ostrea permollis* Sowerby, *Ostrea* was the generic name originally used. Thus if the significance of the parentheses is appreciated, time can be saved in reference work.

## COLLECTION AND PREPARATION OF SPECIMENS

Shells of many—probably most—of the mollusks whose habitat is the nearby sea bottom may be found at some time on the open beaches. Shore collecting is profitable in proportion to the regularity and persistence of the search. It will afford a considerable variety of excellent specimens, and at any time a happy coincidence of time and tide may bring a rare treasure to the hand of the collector.

Collecting is best at low tide. Large shells are oftenest found along the beaches near high water mark and whenever there is an accumulation of sea wrack. After a quiet tide many minute shells lie among the fine detritus left by the ebb tide in ridges along the beach and in any small depressions in the sand. Living mollusks are often washed ashore and many individuals of small species cling to the rough surface of stranded shells or hide within the cavities of sponges and among the branches of hydroid colonies and seaweed. Pieces of water-logged wood, wave worn shells and lumps of coral are worth careful examination for specimens of such boring genera as *Martesia*, *Lithophaga* and *Gastrochaena*. *Rupellaria*, *Corallio-phaga*, and *Modiolus* may be found in cavities not of their own making. A bread sponge may harbor a colony of the uncommon *Ostrea permollis*. Specimens of a parasitic *Melanella* may be found attached to the tough integument of holothurians (sea cucumbers), and the dainty *Erato maugeriae* may share space on the rough valves of *Atrina* with several different species of other small univalves and attached bivalves.

The shell of one living *Atrina rigida*, picked up at random after a windblown tide, yielded the mollusks listed below together with egg capsules of *Anachis avara similis*, *Cantharus tinctus* and *C. multangulus*, and many individuals of other invertebrate groups:—

*Anachis avara similis*, *Anachis obesa*, *Anomia simplex*, *Arca zebra*, *Cantharus tinctus*, *Ischnochiton papillosus*, *Monilispira monilis*, *Rubellatoma diomedea*, *Crepidula fornicata*, *Erato maugeriae*, *Modiolaria lateralis*, juvenile specimens of *Murex florifer arenarius* and *M. pomum*, *Crassostrea virginica*, *Cantharus floridanus* and *Urosalpinx perrugata*.

At the fortnightly times of high tides coincident with the changes of the moon, the ebb exposes a wide extent of beach and leaves dry for a short while many bars and flats of inland waters. At such times specimens of many littoral species may be found alive and perfect, and localities may be explored which are inaccessible in ordinary circumstances. Old pilings of wood or cement and clumps of living and dead oyster shells should be examined; logs and stones turned over; but always and everywhere any object that has been

moved should be replaced in its original position; do not expose to drying and needless death the many small creatures that have been disturbed by the search.

Beyond the limits of the beaches search for living mollusks must be based upon some knowledge of their habits and stations—stations having reference to the particular conditions of environment which are congenial to various species. Association of certain species of mollusks with definite characters of environment is almost invariable. Thus species of *Cerithidea*, *Cerithium*, *Marginella*, *Melongenina*, *Anomalocardia*, *Polymesoda*, and several small *Tellinas* inhabit tidal salt flats and the intertidal zone of inside waters. *Littorina*, *Melampus*, and *Truncatella* live about salt marshes, often out of water for long periods. *Ostrea* and *Modiolus* live about the mangrove fringes of the flats and bayous and are out of water at extreme low tide. *Barnea truncata* is likely to be found in black mud near mangroves, while *Cyrtopleura costata* lives in deeper water, usually where there is an admixture of gravelly bottom with a substratum of marl or silt.

On grassy bottom are found *Modulus*, *Pyrene*, *Cerithium*, *Bitium*, *Rissoina*, *Marginella*, *Smaragdia*, and at certain seasons, *Pecten*. On sandy bottoms, living buried beneath the surface with siphons extended upward into the water are *Chione*, *Mercenaria*, *Transenella*, *Pitar*, *Macrocallista*, *Lucina*, *Tellina*, *Macra*, *Tagelus*; and preying largely on these bivalves *Natica*, *Polinices*, *Terebra*, *Conus*, *Nassarius*, *Cantharus*, and *Urosalpinx* move freely about. Wherever *Mercenaria campechiensis* is found there also are *Busycon* and *Fasciolaria*. *Eupleura* is often associated with a bottom weed known commonly as "rolling moss".

*Dentalium*, *Corbula*, *Nucula*, *Nuculana*, *Lyonsia*, and *Cuspidaria* are found in soft, oozy bottoms beyond low tide mark, although *Lyonsia* is also found in shallow water. On outcroppings of hardpan and about reefs associated with corals, corallines and sponges are found *Murex*, *Cancellaria*, *Leucozonia*, *Xenophora*, *Trivia*, and *Scaphella junonia*, with *Chama*, *Pseudochama*, *Echinochama*, *Spondylus*, *Ostrea cristata*, and *O. frons*. *Pecten gibbus* is a Gulf species apparently living in large, scattered and migratory colonies

in from three to seven fathoms of water. After a northwest blow it is frequently one of the most abundant shells on the beach. With this *Pecten* are associated *Pecten raveneli* and *Pecten ziczac*, but in relatively small numbers, and in depths of five fathoms and more *Pecten nodosus* is found. *Pecten gibbus irradians* is a common bay species. In many localities it is sufficiently abundant to be dredged for the market.

Many species, among them *Cantharus tinctus*, *C. multangulus*, *Muricopsis ostrearum*, *Fasciolaria papillosa*, and *F. hunteria*, *Strombus pugilis alatus*, *Murex florifer arenarius*, *Chione cancellata* and some of the Lucinidae are common at varying depths both in inside and open waters.

A seasonal variation in numbers of individuals is evident in the case of some genera, notably *Pecten*, *Oliva*, *Murex*, and *Fasciolaria*, probably coincident with the spawning period when they seem to seek more shallow water. Spawning of mollusks is observed in the Florida region from November to midsummer, but the season of reproductive activity for individual species is not continuous through this long period. There seems also to be a difference in the abundance of certain pelecypods from year to year as suggested by the presence of their shells on the beaches in great numbers, or their almost total absence for several years; notable examples of this circumstance are *Pecten muscosus*, *Chione cancellata*, *Spisula solidissima similis*, and *Arca zebra*.

For collecting beyond beach limits some equipment is necessary. Convenient containers are needed for shells and pails for living material—nonmetal if animals are to be kept alive for any length of time. Jars and vials should be provided for rare, small, or delicate specimens—some containing 50 per cent alcohol if it is desired to preserve the animal. Forceps, knife, and pocket lens are useful.

Work in shallow water at low tide requires a long-handled shovel and a sieve approximately in size 24 by 18 inches, by some three inches in depth. Its bottom should be of good wire screen, 16 squares to the inch. It is well to have the bottom reinforced with heavier and larger mesh screen. Place a shovelful of sand or mud in the

sieve and wash thoroughly, examine what remains for small mollusks; many of these and other small sand-dwellers will be seen. Repeat this digging and sifting at successive depths in the same spot in order to learn what species live near the surface and which ones burrow more deeply. Continue this process at increasing distances out from shore and in bottoms of different character. Slightly different conditions within a circumscribed locality will afford congenial stations to various species of mollusks. In protected inside waters with varying depths and character of bottom, a great number of species find favorable circumstances and attain perfect development.

The frame of a crabnet rather tightly covered with good quality fine-meshed net or coarse scrim is useful for collecting those species which live among grass or seaweed. The net should be used with a scooping movement, just escaping bottom.

Baited traps may be set and left for 24 hours, at least overnight, since many mollusks are nocturnal feeders. When set in water deep enough to cover the trap, the location should be marked by a buoy. Shrimp, crab, and fish are best for bait, though dead mollusks and bits of meat will attract carrion feeders. Sand fleas (*Hippidae*) have proven exceedingly attractive bait to *Oliva*.

Dredging is the only method of taking living shells of other than shallow water species. By this means material is secured which is otherwise inaccessible or at best represented by occasional beach-worn specimens. In the type of dredge most satisfactory for general work, the cutting blades should be at an angle of about 165 degrees with the bottom of the dredge and the dimension between top and bottom not less than 10 inches. Scallop dredges and tangles have also been used successfully, and a short section of cast iron pipe with a perforated bottom and suitable means of attachment for chains and tow rope is advantageous for learning characters of bottom. Dredges are drawn behind a motor boat with a stout rope two or three times as long as the depth of water—the deeper the water the greater the proportionate length of the tow rope. Five or six feet of galvanized iron chain is attached to each arm of the dredge and joined with a swivel to the towing rope. When dredging is undertaken in depths of water exceeding four or five fathoms a weight should be attached to the tow rope about ten feet ahead of the

dredge. A float should also be attached to the dredge to mark its location in case the tow rope should break.

Everything that comes up in the dredge should be carefully inspected. Starfish, sea urchins, sea cucumbers, hydroids, and seaweeds may be placed in a pail of fresh water for a time—small mollusks that may be upon them will fall to the bottom of the container. Dead shells of *Atrina* afford lodgment to many chitons and small gastropods. *Erato* is often found in the crevices of compound zoöid colonies. *Simnia* clings to gorgonians and exactly matches them in color. *Pteria* and *Pinctada* are attached by a byssus to other shells, or each other, sometimes in large numbers of all sizes together. *Aequipecten muscosus* is covered by a growth of sponge which is firmly established upon the scaly ribs of the bivalve shell. It is interesting to observe that the brilliant yellow- and orange-colored specimens of this *Pecten* are generally embedded in sponge of a purple tint.

It is essential to note and record carefully the locality and depth of water from which specimens are secured, and it is also well to record the date. Specimens which cannot be assigned to a definite locality have no value to a collection.

Cleaning shells has no fascination comparable to the satisfaction of collecting them, but this work must be done thoroughly if the specimens are to be preserved and enjoyed in a permanent collection. Boiling best accomplishes removal of the soft parts. Many collectors prefer to place specimens in warm water and bring to boiling, allowing from two to thirty minutes boiling according to the size of the shells. Highly polished shells should be dropped into boiling water and permitted to remain not more than three minutes. After the shells are sufficiently cool to be handled the soft parts may be removed by gentle traction, taking care not to leave a part of the animal in the apex of a univalve shell; in such event a few drops of 10 per cent solution of formaldehyde left in the shell for a few days will deodorize and harden what soft parts remain. Small specimens may be placed as collected in 50 per cent alcohol and the hardened animal tissue subsequently removed from the shell with an appropriate instrument. Small shells may be washed clean and left to dry without removal of the animal parts, or placed in a jar of fresh water shaken well from time to time and the water fre-



quently renewed until the macerated soft parts are washed away.

After removal of the animal, mechanical cleaning is next to be undertaken by scrubbing with a fairly stiff brush and by the use of some small, sharp instrument to remove calcareous deposits, worm tubes, or barnacles. Care must be exercised to avoid injury to delicate sculpture. Immersion in one of the several commercial cleaning fluids similar to Javelle water, effectively aids mechanical cleaning by loosening the attachments of limy incrustations. Muriatic acid is useful but must be handled with care on account of its corrosive and destructive properties. A solution of one part of commercial acid to three parts of fresh water is sufficiently strong for general use. Shells should not be permitted to remain for more than a few seconds in the acid bath before washing and careful inspection; the bath may be repeated if desired or further application of acid made with a brush interrupted by frequent thorough rinsings. The hands should be protected from contact with the acid.

After specimens are thoroughly cleaned and dried, a film of thin oil may be applied to preserve the surface lustre. Shells which have naturally a high polish may have their surfaces protected by a thin coating of colorless lacquer or an aqueous solution of gum arabic, though this is not necessary. The epidermis and valve ligaments may be kept from excessive drying by soaking the shell for a time in a weak solution of calcium chloride, equal parts of glycerine and water or some other hygroscopic agent. The opercula of univalves should be glued to bits of cotton and adjusted in proper relation to the apertures of the shells from which they were removed. Bivalve shells may be closed and so maintained until the hinge is dry enough to resist opening, otherwise the valves are quite certain to become separated.

Chitons are best handled by placing them in a vessel of sea water as collected until they can be extended on a firm surface and held flat by binding or light pressure until well dried; or they may be left in a shallow dish of sea water until quite relaxed when the water is poured off and the chitons allowed to dry slowly. Unless some such method is followed chitons will contract themselves into a veritable ball from which it is impossible to reduce them without injury.

The characteristic specific features and the intrinsic beauty of shells are best exhibited in well-prepared specimens, but every collection should include a few shells of each species in the undisturbed natural condition, with epidermis intact and incrustations and barnacles unremoved.<sup>4</sup>

Some definite plan of classification should be adopted for the cabinet, and each group of specimens should be clearly labelled with the name, the date, and the locality in which they were collected.

## SYSTEMATIC DESCRIPTIONS

### Class AMPHINEURA

The foundation of this distinct class of the Mollusca is the complete bilateral symmetry of its members. The name Amphineura (from the Greek combining form, *amphi*, both, in both sides; and *neuron*, nerve) refers to the balanced arrangement of the nervous system. The two orders of this class, the Aplacophora—not bearing plates—and the Polyplacophora—bearing many plates, are based upon the absence or the presence of a shell, and the naked mollusks of the first order are the simplest and most lowly organized members of the phylum Mollusca.

The Polyplacophora or chitons have a multivalve shell which covers and protects only the dorsum of the animal's flattened and elongated body. The unprotected ventral surface is equipped with a broad, suckerlike muscular foot, admirably adapted for creeping and for adhering tightly to the firm surfaces of rocks, shells, and corals over which most chitons browse in search of their vegetable food of algae and diatoms. Chitons are native to all seas, usually at moderate depths. They are sluggish creatures, generally nocturnal in habit and appear to avoid light by hiding during the daytime in crevices, dead shells, and under rocks. Some are said to re-

<sup>4</sup> The scientific collectors, or naturalists, are always desirous of having the shells in their rough state, or just as they are fished. This method, though extremely useful, is not to be absolutely followed; not only because their beauties would be lost, but also on account that the different species could never be truly defined. However, as a medium, I would advise all collectors to have some shells of each genus in their rough state, while the others should display their beauties by all the accomplishments of art.—Emanuel Mendes da Costa, 1776.

turn to a chosen resting place after each feeding excursion. Their sizes range between five and one hundred fifty millimeters.

The sexes are separate. Some species lay their eggs singly or in unattached strings, some others retain the ova within the mantle cavity until the shell is formed.

In some tropical countries the muscular foot of large chitons is used as food. Natives of some of the West Indian islands call it "sea beef", and either eat it uncooked or make of it the chief ingredient in a savory loblolly. In the far north, chitons are a reputed cure of seasickness but only when swallowed alive.

The remarkable ellipsoidal shell of the chitons covers only the dorsum of the animal. It is multivalvular, consisting of eight thin plates or valves, transversely wide, gently arched from side to side, and longitudinally keeled in the midline. Each valve articulates with the valve next behind it with a slight overlap toward the posterior end. All the valves are held together and in relation to each other by a girdle of tough, leathery tissue which surrounds the entire periphery of the articulated valves. The overlap of the valves facilitates bending—and the chiton's defensive attitude is assumed by approximating end to end for protection of the vulnerable body. Just so in the early Dark Ages armor plates were fastened to leather, often by rivets; the leather foundation gave flexibility to the coat of mail.

When the valves are separated, which is easily done by a short soaking in fresh water, the head and tail plates are seen to differ from the six intermediates. The anterior valve is roughly semi-circular with a median elevated apex. The posterior valve is much like the intermediates but slopes abruptly to a rounded margin. The intermediate valves are rectangular in outline and show three more or less well-defined areas upon their outer surface; along the keeled mid-ridge of the shell is the jugal or dorsal tract, on each side are the pleural tracts, which in some genera are demarcated from the lateral tracts by an oblique line from near the center of the posterior valve margin toward the outer end of the anterior margin; the sculpture of these areas is important in diagnosis. The valves of most chitons have projecting plates at the free edges which are covered by, and serve as attachment for, the girdle.

The structure of the valves is highly interesting; there are two layers; a quite compact inner stratum and an outer, superficial layer which is perforated by many minute canals perpendicular to the surface, which contain specialized sense organs. In some species these organs have the form of eyes, possessing cornea, lens, pigment layer, and retina.

Species of three genera belonging to this class are described.

Order **POLYPLACOPHORA**<sup>5</sup>

Family **ISCHNOCHITONIDAE**

Genus **ISCHNOCHITON** Gray, 1847

**Ischnochiton**<sup>6</sup> *papillosus* (C. B. Adams)

Pl. 1, fig. 1

Length, 6-8.5; breadth, 5-6 mm. Color mottled olive-green or brown. The sides slope gently and convexly from a moderately keeled mid-ridge. An umbo, central and rounded, on posterior valve. Central and lateral areas of intermediate valves are ill-defined, uniformly and thickly dotted with minute papillae. The narrow girdle is covered with fine overlapping scales. Interior of the shell white.

*I. papillosus* is often found with *Chaetopleura apiculata* adhering to dead shells of *Atrina*.

Genus **CHAETOPLEURA** Shuttleworth, 1853

**Chaetopleura**<sup>7</sup> *apiculata* (Say)

Pl. 1, fig. 2

Length, 17-25; breadth, 10-16 mm. Color varies through buff to ashy-gray or brown, either unicolored or regularly patterned in a darker shade. Occasional specimens are uniformly red or orange color. The dorsum is sharply keeled, the sides slope rather abruptly and are convex. Well-marked oblique lines separate central from lateral areas on each intermediate valve. The central areas bear finely beaded longitudinal riblets. The lateral areas are clearly defined and irregularly dotted with numerous rounded tubercles. The girdle is narrow, with scattered, transparent hairs. Interior white, greenish or grayish.

Family **ACANTHOCHITIDAE**

Genus **ACANTHOCHITES** (Leach MS.) Risso, 1826

<sup>5</sup> Gr., *polys*, many; *placs*, plate; *pherô*, carry; shells have eight over-lapping plates.

<sup>6</sup> Gr., *ischno*, slender; *chiton*, a girdle; Lat., *papilla*, nipple.

<sup>7</sup> Gr., *chaites*, haired; *pleura*, side; Lat., *apiculus*, dim. of apex.

*Acanthochites*<sup>8</sup> *pygmaeus* Pilsbry

Pl. 1, fig. 3

Length, 10-20; breadth, 5-10 mm. Color pale or deep olive or gray-green; less oval and a little more slender than *Chaetopleura apiculata*. Dorsal areas well marked, rather flat and moderately keeled. The sides are flat and sloping and quite evenly covered with small papillae. The girdle partly covers the valves and bears nine small tufts of silvery bristles, evenly spaced, on each side, and a sparse beard of bristle on each end.

This chiton is usually found in shallow water, adhering to dead shells, or crawling in sand near shore line, an unusual habit for a member of this group.

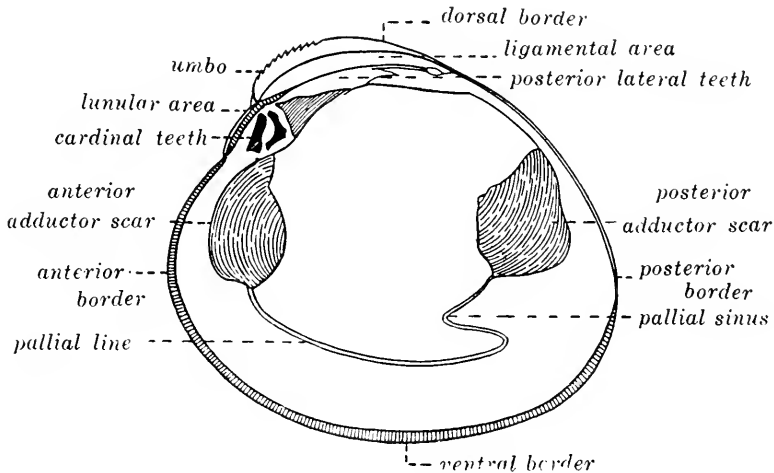


Fig. 1. Diagram showing the characteristic features of a pelecypod.

## Class PELECYPODA

The class Pelecypoda (Gr., *pelekys*, axe; *podos*, foot) is inferior to the Gasteropoda in numbers of genera and species, but in numbers of individuals it surpasses all other divisions of the Mollusca. Along parts of the North Atlantic Coast where *Mya arenaria* finds congenial circumstances, the littoral area may be almost paved with successive generations of this bivalve mollusk. On the Gulf

<sup>8</sup> Gr., *akantho*, thorn; Lat., *pygmaeus*, pygmy.

beach of Sanibel Island, Florida, wind and tide pile up great banks of shells which consist preponderantly of *Noetia ponderosa*, and from time to time incredible numbers of young *Chione cancellata* are washed ashore. Less frequently living *Cyrtopleura costata* are stranded on the beach by hundreds when some unusual tidal current has undermined a colony of them.

Pelecypoda are without distinct heads, and the organs of special sense are not highly developed. The mantle conforms to the shape of the shell. It covers the viscera and contains between its two lobes the gills and mouth parts; its posterior edges are modified to form simple or tubular openings—the siphons—through which currents of water are received into and expelled from the animal's body. Those genera which burrow most deeply have the longest siphons, but in almost every instance the siphons may be completely withdrawn into the shell.<sup>9</sup> Most pelecypods possess a flexible muscular foot well adapted for digging and limited locomotion; in many genera there is a special gland in the foot whose viscous, adhesive secretion hardens on contact with water to form a byssus. The byssal threads issue from between the valves of the shell and become attached by their distal ends to some solid support. The byssus usually consists of fine, silkenlike threads (*Atrina* and *Mytilus*), in some species of the genus *Arca* it resembles thin kidskin, or it may become thick and solidified in other species of the genus. In many of the pelecypods, a byssus is present in juvenile but not in the adult stage, and in certain genera a byssus appears during the late embryonic development.

The food supply of pelecypods is the microscopic plant and animal life of the seas. Currents of water pass through the siphons into the mantle cavity to be depleted of their content of nutriment and oxygen; the waste water, bearing the product of excretion, is expelled in the same manner.

Most pelecypods are unisexual, some are true hermaphrodites,

<sup>9</sup> Small pinfish in an aquarium have been seen by Perry to nip off the siphons of *Tagelus*, *Tellina*, and *Donax* as they were projected above the sand bottom into the water. At the first touch the siphons would be withdrawn, when they reappeared the fish would attack again and eventually the exhausted mollusks were exposed and completely devoured.

but a number of species have been found to exhibit alternately male and female phases of reproductivity.

Bivalve mollusks generally bury themselves in sand or mud. Members of some genera bore into wood, concrete, shells, or coral—into almost any nonmetallic substance—and remain imprisoned in these burrows for the duration of their lives (*Teredo*, *Martesia*). A few genera, as *Modiolaria*, attach themselves to the tissues of other animals, though never as parasites, while others are truly parasitic. *Anomia*, *Chama*, *Ostrea*, and *Spondylus* are attached by one valve. *Pecten* and *Lima*, by a rapid flapping of the valves of their shells, expel a jet of water with sufficient propulsive force to drive themselves through the water for considerable distances.

The Pelecypoda have shells of two joined valves which enclose and protect their soft bodies. In some cases the relative size of the mollusk to its shell is disproportionately large—as in *Cyrtopleura*—and in other instances the valves are rudimentary, and calcareous tubes are secreted about the elongated body, as in *Teredo*. The two valves of the pelecypod shell are joined together by a hinge and maintained in apposition by strong muscles attached to the inner surface of each valve at opposite points. Like the gasteropod shell, the shape of the pelecypod shell is that of a modified cone, flattened from side to side and variously distorted in other dimensions. The apex of each valve is the beak or umbo; the umbos generally point forward with the tips close together and are usually anterior to the hinge ligament. In a few genera, they are directed backward, notably *Donax* and *Nucula*.

An equilateral shell has the umbos at or near the center of the upper margin of the shell (*Spisula*). An inequilateral shell has the umbos much nearer to one end of the shell than to the other (*Arca*). The terms equivalve and inequivalve refer to the relation of the valves to each other in regard to size. The dorsal margin is that which bears the hinge and umbos. The ventral margin is directly opposite the umbos, while the anterior and posterior margins are, respectively, the front and hinder ends of the shell.

Most authorities measure the length of a bivalve shell by a line from the extreme anterior margin to the extreme posterior

margin; the height or altitude is measured by a line from the umbos to a point immediately opposite on the ventral margin. Thickness or diameter is the greatest dimension between the two sides of the closed valves.

In most pelecypod shells the two valves are held together below the beaks by a hinge consisting of interlocking teeth—depressions in the margin of one valve receiving the teeth from the opposite valve. These teeth are distinguished as cardinals, which are those immediately below the umbos; and the anterior and posterior laterals, which are on the respective sides of the cardinals. The teeth are not always identical in every species of a particular genus, but show various modifications in development and position. The hinge ligament is a tough band which fastens the two valves together along a line immediately adjacent to the umbos. This ligament is composed of two distinct parts; the outer portion—the ligament proper—which is usually external and may be seen when the valves are closed; and the inner portion which is cartilaginous and elastic. The ligament proper is inelastic, while the cartilage is highly elastic and compressible, and in its position of rest tends to keep the two valves of the shell slightly separated. Together the two parts of the hinge act in opposition to the strong adductor muscles which close the shell and tend to maintain approximation of the valves so long as they remain contracted.

The more or less heart-shaped depression, close to and anterior to the umbos is the lunule. A corresponding area posterior to the umbos is the escutcheon. The latter occurs in but few genera.

The inner surfaces of the valves show certain impressions or scars, marking the sites of attachments of adductor muscles. When there are two muscles there are two impressions in each valve, the anterior and posterior muscle impressions. When there is but one adductor muscle scar, it is the posterior which is present. The line which roughly parallels the shell margin some little distance from the edge is the pallial line, and the inward recession or indentation of this line is the pallial sinus.

To distinguish between right and left valves, the shell is held with the ventral margin downward and the umbos pointing away



from the observer, the hinge ligament will be behind the beaks. The valve on the right side is the right valve and one on the left side is the left valve. Examination of a single valve shows the umbo pointing to the left when the left valve is seen from the outer side, and toward the right when the inner side is observed. The reverse is true of these genera whose umbos are directed posteriorly. The pallial sinus is always nearest to the posterior end of the shell, and the greatest length is generally behind the umbos.

White and light-colored bivalves sometimes show a pink or purplish tint, deepest on the inner surface of the valves. Heilprin noted this staining and attributed it to some process of ferric oxidation. Since the atypical coloration is usually seen in the shells of living, sand-burrowing bivalves—not in gasteropod shells—it is suggested as perhaps due to the purple secretion of *Tethys* or some tubicolous worm. The purple-colored secretion has been observed to settle in the saucer-shaped depressions in the sand about the projecting siphons of *Cyrtopleura costata* whose shells oftenest show the pink tint. It is possible that the purple secretion which accumulates in these depressions is taken through the siphons into the mollusk's mantle cavity, and either stains the inside of the shell by contact or by the process of excretion. Dead shells of both univalves and bivalves sometimes acquire such a stain, probably by contact with the purple secretions of various marine creatures which settle in depressions where shells are also apt to lodge.

Class **PELECYPODA**

Order **PRIONODESMACEA**<sup>10</sup>

Family **SOLEMYIDAE**

The distribution of the Solemyidae is from Nova Scotia around peninsular Florida and to the West Indies. Their distinguishing feature is the heavy, glossy periostracum which extends well beyond the free margins of the shells in distinct scallops. This family is not well known to collectors. Perry has seen but three specimens in many years.

<sup>10</sup> Gr., *prion*, a saw; *desma*, ligament, saw-toothed.

Genus **SOLEMYA** Lamarck, 1818

Subgenus **PETRASMA** Dall, 1908

**Solemya occidentalis**<sup>11</sup> Reeve

Pl. 42, fig. 303

Alt., 9; length, 25 mm. Equivalve, inequilateral, thin and fragile; umbos suppressed; dorsal margin horizontal; epidermis light chestnut-brown with radiating lighter lines. The epidermis extends beyond the shell margins in deep, rounded scallops with the angles between the scallops at terminations of the light radiating lines; this striking feature of the species gives it the common name "awning shell".

Sandy stations. Shallow water.

#### Family **NUCULIDAE**

The family Nuculidae is represented in all seas. On the Atlantic Coast it is taken from Labrador to Florida and the West Indies, and its range in depth is also great. The mollusks have some unusual anatomical features and are elegant little shells.

Genus **NUCULA** Lamarck, 1799

**Nucula proxima**<sup>12</sup> Say

Pl. 1, figs. 4, a, b

Alt., 5; length, 6.5 mm. Equivalve; obliquely inequilateral with the greatest length parallel with posterior border; umbos small and approximate, directed backward; surface smooth with thin, pale greenish-brown epidermis; sculpture of indistinct growth lines and delicate radiating striae; margins rounded; ventral margin finely crenate within. Hinge is angular with a fossette for internal ligament at angle; 12 comblike teeth anterior to umbos and 18 posterior. Interior pearly; anterior and posterior scars; simple pallial line.

Dredged in sandy mud bottoms in from one to six fathoms. Both *Nucula* and *Nuculana* are eaten by bottom-feeding fish.

#### Family **NUCULANIDAE**

This family is close to the Nuculidae and was formerly included in the same group. Nuculanidae have a wide range in distribution, depth, and temperature but are most numerous in cold seas.

<sup>11</sup> Lat., *solea*, sole, bottom; Gr., *mys*, muscle; Lat., *occidentalis*, pertaining to the west.

<sup>12</sup> Lat., *nucula*, little nut; *proximus*, nearest.

Genus **NUCULANA** Link, 1807**Nuculana acuta**<sup>13</sup> (Conrad)

Pl. 1, fig. 5

Alt., 5; length, 10 mm. Equivalve; extremely inequilateral; posterior to the umbos, the shell is rostrate and prolonged to an acute tip; umbos small, closely approximate, and directed backward. Thin, brownish periostracum; sculpture of well-impressed grooves almost parallel with the ventral margin but not extended over the slightly depressed rostrum which bears fine longitudinal striae. Ventral margin rounded and smooth, dorsal margin posterior to umbos concavely curved; hinge angular, a triangle fossette below umbos; numerous chevron-shaped teeth anterior and posterior to fossette; anterior and posterior muscle scars; pallial line sinuated; interior polished, not nacreous.

There is an aberrant form of *N. acuta* differing from the typical in an entire absence of concentric sculpture. Specimens of each form are commonly taken together.

Dredged from sandy-mud bottom in one to six fathoms.

Family **ARCIDAE**

The family Arcidae is well represented from Maine to Florida and the Gulf Coast by species living in relatively shallow water, and by less common species taken at varying depths up to about 300 fathoms of water. Some members of this group creep about and burrow in sand or mud; some frequent reefs and hard bottom; many attach themselves to some stable point of support by a byssus which can be cast off and quickly removed. Often many individuals are attached to one *Atrina* and to each other. Shells of *Atrina rigida* seem to be especially favored by *A. zebra* and *A. umbonata*. Young Arcas climb the sides of an aquarium by means of their byssal threads, as do young *Mytilus*.

The mollusks of this family are sensitive to changes in intensity of light and will close the shell immediately when a shadow falls upon

<sup>13</sup> Lat., *nucula*, with *ana*, suffix meaning concerned with; *acutus*, from *acuere*, to sharpen.

it. This light sensitiveness is a protection from birds flying above and against the near approach of predatory enemies in the sea. Arcas are said to be the principal food of *Murex*, and the shallow water species are liked by fish and sea gulls.

The blood of mollusks, as a rule, is colorless, but some of this group have red blood whose color is due to a compound of iron.

Shells of the Arcidae may be equivalve or not equivalve, and are usually thick, with a heavy periostracum. They are radiately ribbed and sometimes cancellated. The umbos are directed forward in most genera and more or less separate from each other by a flat, rhomboidal area which is engraved with lines in various angular patterns. The margins may be smooth or dentate, some times crenate within. The hinge is characteristic, a row of comblike teeth along the dorsal margin of each valve for the greater part of its length. The inner surfaces of the valves show unequal anterior and posterior muscular impressions, a pallial line but no pallial sinus.

Genus *ARCA* Linné, 1758

Subgenus *ARCA* s.s.

*Arca*<sup>14</sup> *zebra* Swainson (*A. occidentalis* Philippi)

Pl. 2, figs. 9a, b

Alt., 50; length, 90; diam., 43 mm. Yellowish-white, streaked and patterned with brown, occasional albino specimens; heavy, shaggy, brown epidermis; equivalve; inequilateral; umbos slightly incurved, widely separated; hinge area flat and broad; hinge margin straight; anterior and posterior margins oblique, posterior margin sinuous; ventral margin slightly rounded with wide byssal notch below umbos. About 26 distinct, narrow, rounded ribs with finely ribbed, flat interspaces; fine lamellar ridges cross both ribs and interspaces; hinge typical; interior smooth and purple colored; margins defined by a purplish-brown, polished band, slightly indented posteriorly; muscular and pallial impressions clear; a strong thick byssus.

From three to seven fathoms.

<sup>14</sup> Lat., *arca*, a chest.

**Area umbonata**<sup>15</sup> Lamarek

Pl. 2, fig. 10

Alt., 30; length, 64; diam., 34 mm. Dull white, concentric-shaded markings of brown; shaggy epidermis, heaviest behind; shell not thick and somewhat translucent; equivalve; inequilateral, sharply carinate posteriorly; umbos prominent, recurved, widely apart; hinge margin straight with a little upward curve at posterior end; anterior and posterior margins sinuous, ventral margin rounded with byssal notch below umbos; six to eight definite ribs on the posterior keel, remainder of surface finely and rather irregularly cross-ribbed by growth lines; typical comb-toothed hinge; margins and internal surface of valves smooth, dull purple; muscle scars and pallial line typical; shells often covered with a growth of sponge.

From three to seven fathoms.

Genus **ANADARA** Gray, 1847

Subgenus **SCAPHARCA** Gray, 1847

**Anadara notabilis**<sup>16</sup> (Röding) (*A. auriculata* Lam.)

Pl. 1, figs, 6a, b

Alt., 40-45; length, 60-65; diam., 35-40 mm. Altitude and diameter great in proportion to length. Shell thick, heavy, dirty white with an abundant silky, brown epidermis; equivalve; inequilateral, longest posteriorly; umbos well apart, recurved and directed forward; hinge area widest directly in front of umbos. About 28 rounded ribs with cross sculpture of fine, elevated ridges—almost obsolete in intercostal spaces; the five or six anterior ribs have a central longitudinal furrow; hinge margin straight, ventral and anterior margins rounded, posterior margin sinuous; fine comblike teeth; interior of valves smooth, white, sometimes pink-tinted in umbonal region; inner margin with deep indentations corresponding to ribs and interspaces; well-impressed muscle scars and pallial line. A short, thin, dark-green byssus composed of narrow flat strands expanded in fan shape at distal end to several times its width at byssal notch. In the young mollusk the byssus consists of only a few threads.

Dredged in three to six fathoms.

<sup>15</sup> Lat., *umbo*, beak, tip.

<sup>16</sup> Lat., *notabilis*, noteworthy.

*Anadara transversa* (Say)

Pl. 1, figs. 7a, b;

Pl. 2, fig. 7c

Transversely oblong, rhomboidal, thirty-two to thirty-five ribs placed at nearly the length of their own diameter distant from each other. Apices separated by a long, narrow space, and situated at the termination of the posterior third of the length of the hinge margin; extremities of hinge margin angulated; anterior edge, superior moiety rectilinear; posterior edge rounded; inferior edge nearly rectilinear, or very obtusely rounded; on the hinge space one or two angulated lines are drawn from the apex, diverging to the hinge edge. Length less than seven-twentieths of an inch, breadth one and one-fifth inches . . . Known by apex being situated opposite one-third distance from posterior termination of hinge margin.<sup>17</sup>

A small *Anadara* (Pl. 2, fig. 7c), differing in certain definite characters from the established form *Anadara transversa* (Say), is found on both the Atlantic and Gulf Coasts of Florida. Shells of the two types are commonly associated without differentiation; comparison in regard to shape, relative proportions, sculpture, and dentition reveals differences which seem to be sufficiently well marked and constant to warrant distinction.

Both types are found on sandy bottoms. The depth range of *A. transversa* appears to be less than that of the aberrant form.

From the littoral zone to six fathoms.

*Anadara*<sup>18</sup> *lienosa floridana* (Conrad) (*A. setticosta* Reeve)

Pl. 2, fig. 8

Alt., 50; length, 90; diam., 45 mm. Heavy, white, thick brown epidermis; equivalve; inequilateral; umbos somewhat incurved and flattened; hinge margin straight, anterior and ventral margins rounded, posterior margins straight and obliquely angled with hinge margin. Thirty-five ribs which markedly widen as they diverge, a deep central groove in each rib which does not extend over umbos and is absent from the rounded posterior ribs; fine ribbing crosses both ribs and the concave intercostal spaces. This fine, transverse ribbing serves—as in other *Anadaras*—for attachment of the scales of the epidermis. Hinge typical. Interior of valves show delicate linear markings; margins dentate; well-impressed muscle scars and pallial line; byssus long, thin, flat, and broken up into many narrow strands.

<sup>17</sup> Say's description, read July 24, 1821. Journal Academy of Natural Sciences, vol. 2, pt. 2.

<sup>18</sup> Lat., *lien*, *lienosa*, spleen, splenetic.

From two to five fathoms.

Genus **BARBATIA** Gray, 1842

**Barbatia tenera**<sup>19</sup> (C. B. Adams)

Pl. 40, fig. 288

Alt., 25; length, 35; diam., 15 mm. White, translucent, a soft shaggy, brown epidermis covers the shell except over the umbos and is heaviest posteriorly; equivalve; nearly equilateral; umbos high, near together and strongly recurved; hinge area narrow, flat, ill defined; hinge margin almost straight; anterior and ventral margins rounded, posterior margin strongly curved outward; sculpture of numerous fine, close ribs, stronger posteriorly, all crossed by growth lines; hinge typical but not strong; interior smooth, white, finely lined; margins smooth; pallial line and muscular scars present. Specimens from the Gulf of Mexico are somewhat smaller and thinner than Atlantic individuals.

Dredged at two fathoms.

Subgenus **ACAR** Gray, 1857

**Barbatia domingensis** (Lamarck) (*A. reticulata* Gmelin)

Pl. 3, fig. 11

Alt., 7; length, 20; diam., 10 mm. White, fairly thick, with thin, light-colored epidermis; equivalve; inequilateral, keeled at posterior end; umbos recurved and closely approximate; hinge area small, margin straight; ventral margin slightly curved with byssal notch below umbos; anterior margin curved, posterior margin strongly curved at junction with ventral margin; reticular sculpture of radiating ribs crossed by stronger, concentric, almost lamellar growth lines; interior white, smooth, margins finely crenate; muscle scars and pallial line well defined; byssus comparatively large, thick and flattened.

Taken about reefs.

Genus **ARCOPSIS** von Koenen, 1885

**Arcopsis adamsi conradiana** (Dall)

Pl. 3, fig. 12

Alt., 7; length, 12; diam., 5.5 mm. Shell white, sometimes brown-

<sup>19</sup> Lat., *tenera*, delicate.

ish; inequilateral, moderately thick; umbos well above hinge margin, anterior to middle, rounded and obtuse; anterior margin rounded, posterior margin oblique, hinge and ventral margins parallel; strong posterior rostration; sculpture of lamellate or beaded ribs and growth lines, less prominent over umbos and central area; about eight anterior and twelve posterior teeth; margins finely crenate.

Dredged from rough bottom about reefs.

Genus **NOETIA** Gray, 1857

Subgenus **EONTIA** MacNeill, 1938

**Noetia ponderosa**<sup>20</sup> (Say)

Pl. 3, fig. 13

Alt., 42; length, 60; diam., 36 mm. White, thick, heavy; strong, black epidermis; equivalve; obliquely inequilateral; umbos well separated, incurved; sides of hinge area slope obliquely downward to a straight margin; hinge typical; posterior margin almost straight, carinate; anterior and ventral margins rounded. Thirty-two flattened, radiating ribs and fine, concentric intercostal sculpture which is absent from the umbos. Interior smooth, marginal indentations correspond with ribs; strong muscular impressions; simple pallial line; no byssus.

On sand and gravel bottoms, often about rock reefs. Living *Gorgonia* often attached to shell.

Family **GLYCYMERIDAE**

Genus **GLYCYMERIS** da Costa, 1778

**Glycymeris**<sup>21</sup> *pectinata* (Gmelin)

Pl. 3, figs. 14a, b

Alt., 21; length, 21; diam., 11 mm. Rounded and ribbed, suggesting a fan shape; dull white with irregular brown cross-markings; thin, brownish epidermis; equivalve; equilateral; central, small, pointed umbos; margins rounded; about 24 rounded ribs with narrow interspaces, ribs on anterior and posterior parts of shell much smaller than median ribs; fine reticulate sculpture on umbos of un-

<sup>20</sup> From Noe, Noah, fem., Lat., *ponderosus*, a weight.

<sup>21</sup> Gr., *glykys*, sweet, with *meris*, share, part; Lat., *pecten*, a comb.



worn shells; hinge area narrow, hinge teeth follow the rounded edge of margin and incline obliquely outward; interior smooth, sometimes purple stained; anterior margin crenate; impression of two adductor muscles and pallial line present; no byssus.

Dredged from sand and gravel bottom in three to six fathoms.

#### Family PINNIDAE

The Pinnidae are native to warm and temperate seas and moderate depths. They live partly buried in the sea bottom, securely anchored by a long-haired byssus, whose individual golden-brown strands are so fine and silky that the nobility of ancient Greece and Rome were proud to possess a garment woven from them. It has been said that the Golden Fleece, which lured young Jason to Colchis in the heroic days of Greece, was a garment made of the spun byssuses of a Mediterranean species of this family. Gloves and other articles made from byssuses of the same *Pinna* may be seen today in Italy, but rather as objects of interest than as articles of luxurious apparel.

Extra large scallops offered in the markets are apt to be the adductor muscles of these mollusks masquerading as the true scallop which is the muscle of *Pecten*.

Black pearls are sometimes found in the mantle of *Pinna* or as baroques on the nacreous lining of its valves. A little crab (*Pinnotheres*) lives commensally in the mantles of *Pinna* and *Atrina*—some old tales recite the benefit the crab was believed to bestow upon its host by pinching him when a little fish entered between the gaping valves.

Shells of the Pinnidae are large, trigonal, with sharp apices at the anterior extremities. Posterior borders extremely rounded and somewhat gaping; dorsal margins straight or with slightly concave curvature; ventral margins rounded; hinge teeth are present on the dorsal margin, and a long linear ligament is lodged in a trench extending about two-thirds of the marginal length. The quality of the shell is brittle and translucent, a nacreous layer which scales off readily, covers about two-thirds of the interior of the valves. Impressions of two muscles and pallial line are distinct. In the genus

*Pinna* the valves are medially sulcate; valves of *Atrina* lack such sulcation.

Genus **ATRINA** Gray, 1842

*Atrina*<sup>22</sup> *rigida* (Solander)

Pl. 3, fig. 15

Length, 250; width, 130 mm. Shell with characters of the family; olive-brown; outer surface bears about 15 elevated ribs, with intercalations of smaller ribs posteriorly; ribs not well developed toward apex and ventral border. Each rib bears a series of sharply elevated, tubular or semitubular spines; the spines—like the ribs—are lost on the umbonal and ventral portions of the shell; a fine, long, silky byssus.

*Atrina serrata*<sup>23</sup> (Sowerby)

Pl. 3, fig. 16

Length, 260; width, 140 mm. Shell with characters of the family. A little larger than *A. rigida* with posterior margin less rounded. Surface sculpture of closely placed ribs bearing deeply curved, semierect scales which are much reduced over ventral and umbonal areas.

Both species of *Atrina* are common on the beaches after blows, found from low tide mark to six fathoms.

Family **PTERIIDAE**

The modest exterior of the shells of the Pteriidae belies the family's claim to high distinction, for one of its genera includes the great pearl oyster of the South Seas and the *Pinctada* which responds to the exquisite skill of Japanese pearl culture. The secretion of nacre is a function common to all the members of this group. An occasional free pearl, but oftener a baroque, is found in the native species of *Pinctada*.

The Pteriidae are mollusks of warm seas and moderate depths. Their shells are variable in shape and size, inequivalve; inequilateral—often winged with a byssal notch.

<sup>22</sup> Lat., *atrium*, an opening; *rigere*, to be stiff.

<sup>23</sup> Lat., *serra*, a saw.

Genus **PTERIA** Scopoli, 1777**Pteria**<sup>24</sup> *colymbus* (Röding)

Pl. 4, fig. 17

Average alt., 35; length, 55 mm., many individuals exceed these dimensions. Shell is inequivalve, inequilateral, eared, obliquely winged toward posterior; color brown with lighter, radiating bands; fresh shells have a light-colored periostracum, lamellar in growth, with spiny projections along the light radiating bands often extended in a fringe beyond the shell margin; umbos well anterior to middle, not projecting above cardinal margin; ventral margin oblique, rounded, byssal notch near anterior ear; posterior margin concave; hinge margin straight with posterior ear short or greatly elongated; two small cardinal and one lateral tooth in each valve; a single muscular impression, large, almost central; interior of valves nacreous, pearly lining does not extend to free margins; byssus of silky, brown threads.

Common on beaches. Dredged in three to seven fathoms.

Genus **PINCTADA** Röding, 1798**Pinctada** *radiata*<sup>25</sup> (Leach)

Pl. 4, fig. 18

Average alt., 45; length, 43 mm. Shell somewhat quadrate, slightly oblique; thin, flattened, byssal notch under anterior ear of right valve; posterior ear not defined from posterior margin; outer layer of shell laminated, with scaly projection concentrically arranged; this ornamentation is lacking in many specimens; brownish color; occasionally a fine green color replaces the brown tone; single lateral tooth in left valve, double laterals in right; interior nacreous; wide, polished border about margins.

Common on beaches. Dredged with *Pteria colymbus*.

Family **OSTREIDAE**

Ancient kitchen middens composed mainly of oyster shells and found in many parts of the world which were inhabited by primitive man testify to the importance of this mollusk in the economy of that era, and no mollusk of our own time enjoys greater gastronomic popularity. Oyster culture has a record and a tradition from the first century B.C., and the patrician Roman of that time was able to dis-

<sup>24</sup> Gr., *pteron*, wing; *kolymbos*, a diver.

<sup>25</sup> Span., *pintado*, marked with spots; Lat., *radius*, a ray, rayed.

criminate between the flavors of oysters from different vivaria.<sup>26</sup>

Like the Lucrine beds of old Italy certain locations in America are famous for the flavor of their oysters, and oyster culture in the United States is estimated to have an annual value to growers of \$30,000,000, including a considerable export trade to Europe.

Distribution of the family is general in warm and temperate seas. They are all marine, and after the larval state is past they are permanently affixed by the left valve of the shell to some base of support. The shells are generally inequivalve with inconspicuous curved umbos. The hinge has an internal ligament lodged in a triangular fesse; no cardinal teeth; a single muscular impression and an indistinct pallial line. The structure of the shell is lamellar; the interior is smooth and polished but not nacreous.

In the shallow tidal waters of Western Florida the common oyster forms reefs and bars of considerable size and of some importance to the navigation of small crafts. Along the shores of the bayous and creeks the pendant branches of mangrove trees are weighted with clumps of living oysters; many of these oysters are killed during a season of excessive rainfall when drainage into the creeks is sufficient to reduce the normal salinity of the water below the point of the mollusk's requirement.

Genus **OSTREA**<sup>27</sup> Linné, 1758

**Ostrea frons**<sup>28</sup> Linné (*O. limacella* Lam.)

Pl. 4, fig. 20

Small, size variable up to alt., 45; length, 25 mm. Shells are rosy brown, characterized by a broad, longitudinal midrib with

<sup>26</sup> Common people are indifferent about the *manner of opening Oysters*, and the times of eating them after they are opened; nothing however is more important in the eyes of the experienced Oyster eater. Those who wish to enjoy this delicious restorative in its utmost perfection must *eat it the moment* it is opened, and with its own gravy in the under shell; if not *Eaten while absolutely Alive*, its flavor and spirit is lost . . . . . The true lover of an Oyster will have some regard for the feelings of his little favorite, and will never abandon it to the mercy of a bungling operator, but will open it himself, and contrive to detach the Fish from the shell so dexterously that the Oyster is hardly conscious that he has been ejected from his Lodging, till he feels the teeth of the piscivorous Gourmand tickling him to death.—Cook's Oracle, Harper, 1830.

<sup>27</sup> Lat., *ostrea*, from Gr., *ostron*, bone.

<sup>28</sup> Lat., *frons*, leafy twig or branch.

lateral transverse folds in a pectinate arrangement from midrib to margins. The attached valve bears several curved processes which embrace the stem of a gorgonian or some other twiglike support, and attach the shell securely in its long axis. Shell margins deeply serrate, points interlocking; interior white, polished; hinge, muscular impression and pallial line typical.

Dredged in four to six fathoms—usually about reefs.

**Ostrea cristata**<sup>29</sup> Born (*O. spreta* d'Orbigny) Pl. 4, fig. 21

Alt., 40; length, 40 mm. Irregular, often rounded, attached valve deep, free valve rather flattened; surface of both valves folded into deep, radiate plications which extend to margin of shell and there form acute, interlocking serrations. Umbo of attached valve definitely longer than its fellow. Interior white, polished; often a callus deposit at site of the single muscle scar. Claspings processes similar to those of *O. frons* are developed in the lower valve, but are frequently expanded into pillarlike attachments when the shell rests upon a flat surface—often valves of *Atrina* and *Pteria*.

Dredged with *O. frons*.

**Ostrea permollis**<sup>30</sup> Sowerby Pl. 4, fig. 22

Alt., 30; length, 20-26 mm. Shell flattened, variable in shape and outline, usually rounded but sometimes almost quadrangular. Moderately thin, translucent, golden color with delicate epidermis; parts of the shell which are exposed lack the golden hue. Almost equivalve, umbos flattened to plane of valves and abruptly recurved to right and left on respective valves. Distinct growth lines; interior white. This oyster lives embedded in the substance of the "bread sponge".

Genus **CRASSOSTREA** Sacco, 1897

**Crassostrea virginica** (Gmelin) (*Ostrea virginica* Gmelin) Pl. 4, fig. 19

Size variable according to locality and food supply; shape irregular-elongate, sometimes nearly circular. The shell is fixed at the umbonal region of the left valve which is larger and deeper, but

<sup>29</sup> Lat., *cristatus*, crested.

<sup>30</sup> Lat., *per*, very; *mollis*, soft.

shorter, than the flattened upper valve. The umbo of the left valve is lengthened and strong and may be directed either forward or backward. Umbo of right valve is short. Both umbos have a central channel in their approximate surfaces for ligamentary attachment. The surface of the lower valve is lamellate and folded; that of the upper valve is lamellate, ribbed, and often spiny. Margin more or less deeply serrate; interior of valves smooth with a central spot of deep purple and a prominent subcentral muscle scar.

Oysters are preyed upon by carnivorous mollusks, *Busycon*, *Melongena*, *Fasciolaria*, and many are eaten by sheephead from the oyster bars, mangrove roots and pilings.

#### Family SPONDYLIDAE

The two American East Coast genera of the family Spondylidae are distributed in warm waters southward from North Carolina, through the West Indies, and in the Gulf of Mexico to Texas. The genus *Spondylus* includes the thorny oyster, one of the most extraordinary of marine shells in its development of protective spines and in brilliancy of color.

The shells are inequivalve, attached by the right valve which is larger and deeper than the upper left valve. The hinge is of peculiar interest, it is unusually strong and permits only limited separation of the valves; there is a central ligamentary fossette and two cardinal teeth in each valve, the teeth articulate with sockets in the opposite valve.

#### Genus SPONDYLUS Linné, 1758

##### *Spondylus*<sup>31</sup> *ictericus* Reeve

Pl. 5, fig. 23

Alt., 70; length, 55 mm. Shell rounded, trigonal, irregular; colored in shades of red and orange; inequivalve; eared; fixed by a triangular area at umbonal extremity of right valve, the surface of this triangular area is white with a deep longitudinal slit for the lodgment of a portion of the elastic ligament. The fixed valve is normally deeper than its fellow, but is frequently flattened in whole or in part by pressure from adjacent reef structures; its surface

<sup>31</sup> Gr., *spondylus*, vertebra; *icterikos*, jaundice.

bears many foliate lamellae. The upper valve is radiately ribbed; prominent ribs alternating with delicately ribbed interspaces which show slightly stronger ribs in the center. The primary ribs bear many sharp, spinose processes; the intermediate ribs show a similar tendency, often expressed as a beading. Margin rounded. Hinge of two strong cardinal teeth in each valve and a powerful elastic ligament; interior of valves smooth, pink or lavender tinted, margins red-bordered and crenate. Single muscle scar; simple pallial line.

On reefs in five or more fathoms. Best taken by use of a tangle.

**Spondylus americanus** Hermann

Frontispiece

Alt., 112; length, 95; thickness, 65 mm. Shell suborbicular; eared, narrowed trigonally near the umbo of the upper or right valve, which is higher and more inflated than the left. Basic color white, with yellow, orange or shades of red near the umbos; less likely to be affixed than *Spondylus ictericus*. Both valves have six to eight radial ribs with long, curved, palmate spines. Between these heavy ribs are three or four finer ribs with short, pointed spines. Umbo of lower valve widely extended beyond upper valve, showing a triangular, smooth, white area, split in the center, from which extends the elastic ligament which controls the hinge. Each valve has two heavy, cardinal teeth and two corresponding sockets.

Inside of shell smooth and white, in some instances having a trace of color on the rounded, denticulate margin. One large muscle scar about 30 mm. in diameter.

Dredged in five or more fathoms. Brought up frequently by the sponge fishermen from Tarpon Springs.

The *Spondylus* is usually covered with sponge, which tends to protect the long, delicate spines. The Mediterranean species is said to have been the inspiration for the first mechanical hinge, copied for its perfection and efficiency of construction.

Genus **PLICATULA** Lamarck, 1801

**Plicatula**<sup>32</sup> *gibbosa* Lamarck

Pl. 5, fig. 24

Alt., 25; length, 24; diam., 10 mm. Shell solid, thick, irregular,

<sup>32</sup> Lat., *plicatus*, folded, *ula*, fem. dim.; *gibbus*, a hump.

roughly trigonal in shape with apex at umbos; widest at junction of lateral and ventral margins. Ground color white with fine pencillings of reddish brown. Slightly inequivalve with small, flat area of attachment near umbo of right valve. Each valve has an equal number of strong radiate plications sometimes slightly serrate, lateral margins minutely serrate. Hinge typical of family; interior of valves white, plicate towards margin; single, subcentral, laterally placed muscular impression, often a little elevated; simple pallial line.

Dredged in two to six fathoms.

*Gastrochaena* burrows into the valves of living *Plicatula*, and small shells of *Rupellaria typica* have been found in its cavities. In one instance an individual of each species was in one burrow. Perry has found living *Gastrochaena* in burrows which had no communication with the outer surface of the valve.

#### Family PECTINIDAE

All seas have representatives of the Pectinidae, and their bathymetric range is from shallow water to profound depths. Shells of many species are brightly colored in shades of red, yellow, rose, pink and purple. The mollusks are sensitive and active and able to change not only position but also location by a rapid opening and closing of the shell valves. At rest they lie upon the right valve which is often colorless or paler than the left valve, and when the mollusk is undisturbed the valves of the shell remain slightly separated, showing the closely plaited mantle edge studded with brilliant metallic-blue eyes placed at intervals corresponding to the scallops in the shell's margin.

Aristotle and Pliny were acquainted with several species of this group and made the comparison of the ribbed shells to the teeth of a comb. It is quoted from Pliny that little fleets of scallops may be seen floating upon the surface of the sea, with one valve raised to make a sail, but this phenomenon has not been noted since Pliny's time.

The life time of *Pectens* is thought to be about two years. Reproductive maturity is reached within a year.



The shells are free, equivalve or inequivalve; equally or subequally eared, with a byssal notch under the anterior ear of the right valve; hinge margin straight; hinge has an internal cartilage fixed in a triangular fosse in each valve; some species show small insignificant lateral teeth; umbos central. Surface usually ribbed and margins scalloped; single muscular impression, subcentral and near posterior margin; simple pallial line. Pectens are byssiferous in the juvenile stage and some species retain this quality through adult life.

Genus **PECTEN** Müller, 1776

**Pecten**<sup>33</sup> *raveneli* Dall

Pl. 5, figs. 25a, b

Alt., 40; length, 45; diam., 12 mm. Color varies through shades of pink to purple with a few rare gold-colored individuals. This is one of the "fan shells". Hinge margins straight; ears subequal; umbos flat, central; ventral margin an almost perfect semicircle; upper valve flat with median area slightly depressed, deeply colored with irregular dark markings; about 21 rounded, radiating ribs with wider interspaces, fine concentric growth lines; interior of valve smooth with margin beyond pallial line showing elevated ribs corresponding to external interspaces, each rib with a median sulcus; lower valve deeply concave, pink-tinted without, pinkish margin within; ribs with a central groove and wider than those of the upper valve; inequivalve, margin of lower valve extends beyond that of the upper valve. Single muscle scar; simple pallial line.

**Pecten** *ziczac*<sup>34</sup> (Linné)

Pl. 5, fig. 26

Alt., 55; length, 55; diam., 13 mm. Color range similar to that of *P. raveneli*, but with lower valve tinted only toward ears and umbo. Inequivalve, margin of lower valve extends beyond margin of upper valve. Upper—left—valve flat with central concavity; there are about 35 flattened, radiating ribs—alternate ribs more prominent; smooth lateral areas of about 8 mm. width; inner surface of valve white, dark border and deep stain about ears and umbo; lower

<sup>33</sup> Lat., *pecten*, a comb; dedicated to Dr. Ravenel, conchologist.

<sup>34</sup> Ger., *zickzack*, origin uncertain; a series of sharp turns in a course.

valve deeply concave, ribbed; external ribs broad and separated by narrow grooves; internal ribs with central sulcus. Interior white.

*P. raveneli*, *P. ziczac*, and *A. muscosus* are taken together in five to seven fathoms.

Genus **AEQUIPECTEN**<sup>35</sup> P. Fischer, 1886

**Aequipecten muscosus**<sup>36</sup> (Wood)

Pl. 5, fig. 27

Alt., 48; length, 46; diam., 18 mm. Surface spinose, rough; valves uniformly colored; color range through brown, red, orange, lemon and apricot shades; almost equivalve; ears unequal. Each valve bears about 20 prominent ribs with finely ribbed interspaces; ribs closely set with small, sharp, projecting scales; marginal scallops correspond to ribs. Interior of valves ribbed and tinted with a pale shade of exterior color. This *Pecten* is usually covered with a growth of sponge, and adult individuals are usually attached by a byssus.

Stormy blows often bring this *Pecten* to the beaches in great numbers.

**Aequipecten gibbus**<sup>37</sup> (Linné)

Pl. 6, fig. 28

Alt., 50; length, 52; diam., 25 mm. Shell with family characters. Color and pattern of bright or dull pinks and reddish purples on white ground, variable; pure yellow specimens occur and some blending of the two forms is seen. The upper valve is always more gayly colored; interior delicately tinted in accord with exterior coloration. Right—lower—valve deeper and umbonal elevation a little higher than in left valve; about 20 rounded, radiated ribs, smooth area below ears; concentric sculpture of fine laminations; deep marginal scallops formed by the ribs, interlock and overlap.

Taken only in the Gulf in more than three fathoms. Common on the beaches after blows.

**Aequipecten gibbus irradians**<sup>38</sup> (Lamarck)

Pl. 6, fig. 29

Alt., 75; length, 75; diam., 34 mm. Shell with family charac-

<sup>35</sup> Lat., *aequus*, *aequi*, equal.

<sup>36</sup> Lat., *muscus*, moss, often covered with sponge.

<sup>37</sup> Lat., *gibbus*, a hump.

<sup>38</sup> Lat., *irradiare*, to irradiate.

ters; right valve more deeply concave, humped in umbonal region; upper valve mottled gray or brown on white, lower valve white with gray or brown near umbo; a variant type is orange or lemon color. Nineteen to 23 ribs, narrow ribbing over lateral areas and auricles; fine concentric laminations crossing ribs and interspaces; marginal interlocking of ribs exaggerated.

This is a lagoon form which is often taken for market. It appears to spawn in shallow water among eel and turtle grass. Young individuals are found attached to grass blades by threads of byssus.

Genus **LYROPECTEN** Conrad, 1862

***Lyropecten nodosus***<sup>39</sup> (Linné)

Pl. 6, fig. 30

Alt., 95; length, 100 mm. Shell with family characters. Almost equivalve, ears unequal; eight or ten large primary ribs, both surface ribs and the wide interspaces uniformly and narrowly ribbed; knoblike nodes developed at more or less regular intervals on the primary ribs—this character is variable; ears and lateral areas finely ribbed; concentric sculpture of fine lamellae, strongest in intercostal spaces but sometimes wanting; interior of valves radiately channeled, smooth, reddish colored—deepest near margins.

Dredged, usually on hard bottom in five to eight fathoms. Young individuals of less than ten millimeters have been taken in five to six fathoms. Not uncommon on the beach after a northwester.

#### Family **LIMIDAE**

The living mollusks of the family Limidae possess a delicacy and vivacity which makes them especially attractive subjects for observation. Most of them are red or orange color, with a veil-like, closely plaited mantle which bears numerous extensile, filamentous tentacles which are almost constantly in motion. In an aquarium *Lima* may be seen to move quite easily over the glass surface by fixing the free extremities of several tentacles, then by contracting them the animal is drawn into a new position. Limas can also swim—as do Pectens—by a rapid flapping of the shell valves; the action is

<sup>39</sup> Lat., *lyra*, lyre-shaped; *nodus*, knot.

performed effectively, for the valves may be separated to an extreme degree and approximated with sufficient force to propel the creature rapidly through the water with a motion which suggests the wing-beat and flight of birds. Perry has seen a swimming *Lima inflata* caught by the expanded tentacles of a sea anemone and immediately ingested.

Some species of *Lima* construct funnel-shaped nests from fragments of shell, bits of debris and seaweed, and if removed therefrom the owner is said to return to his home.

The family is represented in all seas and has a considerable range in depth.

Genus **LIMA** Bruguière, 1797

Subgenus **LIMARIA** Link, 1807

***Lima*<sup>40</sup> *inflata*** (Gmelin)

Pl. 6, fig. 31

Alt., 25; length, 16; diam., 8 mm. Shell obliquely oval, inflated, pure white and fragile; translucent valves in contact only at ventral border, with a thin, brownish periostracum; equivalve; inequilateral; auriculate; anterior margin straight; posterior and ventral margins rounded; hinge margin oblique; umbos prominent, central, small and sharp. Sculpture consists of delicate, unequal ribs and obscure, concentric growth lines; ribs are scarcely elevated in umbonal region and toward the margins they bear small toothlike imbrications which render the name *Lima* appropriate. Hinge partly external, a portion of the ligamental area is visible below the umbos; no hinge teeth; interior of valves polished, single muscle scar, subcentral and near posterior margin; simple pallial line; margins finely serrate. The mollusks secrete delicate byssal threads.

#### Family **ANOMIIDAE**

The Anomiidae are native to warm and temperate seas all over the world and to depths beyond the littoral zone to about 20 fathoms.

In the adult stage the mollusk is fixed; the young *Anomia* has a bivalve shell and is a free-swimming creature until a byssus is secreted and sedentary life begun. At an early stage in the develop-

<sup>40</sup> Lat., *lima*, a file; *inflatus*, from *inflare*, to inflate.

ment of the shell a notch appears in the margin of the right valve. This notch is deepened by progressive marginal growth until it finally becomes an opening more or less isolated from the shell margin and in position to allow passage of a byssus which becomes calcified and permanently fixed. A strong muscle unites the inner surface of the byssal plug with upper valve of the shell.

Genus **ANOMIA** Linné, 1758

**Anomia**<sup>41</sup> *simplex* d'Orbigny

Pl. 6, fig. 32

Alt. to 40; length to 44 mm. Shell fixed, inequivalve, usually subcircular and conforming to the contour and sculpture of its base. Structure lamellar, translucent, color golden or silvery with a lustrous exterior and nacreous lining; upper valve slightly convex, interior with transverse ligamentary fossette and muscle impressions. Lower—right—valve flattened, with byssal sinus near apex; sinus not closed at marginal border; pallial line indistinct.

Dredged in one to six fathoms.

Genus **PODODESMUS** Philippi, 1837

**Pododesmus**<sup>42</sup> *rudis* (Broderip) (*P. decipiens* Philippi)

Pl. 6, fig. 33

Shell larger than *Anomia*—up to 45 mm. Inequivalve, superior valve convex, exterior brownish, rough, with narrow, irregular riblets, sometimes scaly; concentric growth lines; inferior valve adapted to shape of its support; byssal sinus similar to *Anomia*; pearly lining; one muscle scar.

Taken with *A. simplex*.

#### Family MYTILIDAE

The Mytilidae is a large and widely distributed family, best represented in cold seas, but having various genera which are adapted to warmer waters. Some European members of the family rank near the oysters and clams in economic importance, mussels having been cultivated for food along the French and Belgian coast for several centuries. All mussels are edible. They are not generally esteemed in the United States as food but are much used as bait for bottom-feeding fish.

<sup>41</sup> Gr., *anomos*, without law.

<sup>42</sup> Gr., *podos*, foot, *desmos*, ligament; *rudis*, rough.

Some species make a nidus from fragments of debris entangled by byssal threads, and others form cavities in wood or coral. The family is byssiferous.

The shells are equivalve, longest from umbonal region to opposite margin; not auriculate; inequilateral with sharp umbos. There is a linear hinge ligament, either marginal or partly internal; teeth are absent or feeble; impressions of two adductor muscles—the anterior small, the posterior large and indistinct. Pallial line almost always simple. Interior of valves polished but not nacreous and often of a purple color. The ventral border gapes for passage of a byssus. All have an epidermis.

Genus **BRACHIDONTES** Swainson, 1840

**Brachidontes<sup>43</sup> recurvus** (Rafinesque)

Pl. 7, fig. 34

Alt., 30; length, 40 mm. Color dark purplish; shell strongly and obliquely upcurved; umbos anterior, acute, terminal; hinge margin concave, slightly sinuous; anterior and ventral margins sharply curved and continuous; posterior margin rounded; valves finely and closely ribbed; umbos smooth; interior dark purple, nacreous; margins finely crenate with byssal sinus.

Common in shallow water, often among roots of mangrove trees.

**Brachidontes exustus<sup>44</sup>** (Linné)

Pl. 7, fig. 35

Alt., 10; length, 28 mm. Shell color bluish gray with bright brown; epidermis thin, brown; surface finely ribbed; shell oblique, inflated below hinge margin which is short and straight; ventral margin long, almost straight; interior purple, nacreous, color pale about borders; margins crenate.

Common on the beach attached to *Atrina* and to each other. Dredged in three to six fathoms.

<sup>43</sup> Lat., *brachium*, arm; Gr. *dontes*, teeth.

<sup>44</sup> Lat., *exustus*, past part. of *exurere*, to burn up.

**Brachidontes citrinus**<sup>47</sup> (Röding)

Pl. 7, fig. 38

Alt., 14; length, 38 mm. The shape resembles *B. exustus*, is larger and more slender; bluish gray covered with bright yellow epidermis; surface ribbed, smooth anteriorly; umbos small, round, incurved; interior white, stained with purple; margins smooth, epidermis reflected internally.

Not ordinarily found on the beaches. Dredged in three to six fathoms.

Genus **MODIOLUS** Lamarek, 1799\*

**Modiolus**<sup>45</sup> **americanus** (Leach) (*M. tulipus* Linné)

Pl. 7, fig. 36

Alt., 33; length, 65 mm. Shell moderately thick, translucent, smooth except for incremental lines; color brown or yellowish brown, with red undertone; epidermis glossy brown, shaggy toward posterior end; umbos anterior, incurved, closely approximate, not terminal; shell inflated, slightly carinate above, a shallow sulcus below; interior pink near umbos, purple, nacreous; epidermis reflected over smooth margins.

This is a nest building species. Common on Gulf beach, dredged in three to seven fathoms.

**Modiolus demissus**<sup>46</sup> **granosissimus** (Sowerby)

Pl. 7, fig. 37

Alt., 30; length, 65 mm. Shell brown with thin brown epidermis; sculpture of fine ribs cut transversely into granules; lower anterior portion of valves smooth; umbos inconspicuous, anterior, not terminal, often eroded through to nacreous layer; hinge margin slightly convex, other margins slightly rounded; byssal opening below; interior purple, nacreous, margins crenate.

A shallow water species, often found on oyster bars.

Subgenus **AMYGDALUM** <sup>48</sup> Megerle von Mühlfeld, 1811

**Modiolus papyria**<sup>49</sup> (Conrad) (*Mytilus arborescens* Dillwyn)

Pl. 7, fig. 39

Alt., 8; length, 22 mm. Shell fragile, smooth, polished, and iridescent greenish color; thin, transparent epidermis; inconspicuous

<sup>45</sup> Lat., *Modiolus*, a small measure.

<sup>46</sup> Lat., *demittere*, to send away; *granosus*, full of grains.

<sup>47</sup> F., *citrine*, yellow, from Lat., *citrus*, citron tree.

<sup>48</sup> Lat., *amygdalum*, an almond.

<sup>49</sup> Lat., *papyrus*, paper.

\* Opin. 325, Int. Rules-Zool. Nomen., Jan. 7, 1955, *Modiolus* Lam., 1799, is validated and *Folsella* Scopoli, 1777 is suppressed.

umbos, anterior, not terminal; hinge margin straight; valves rounded; interior nacreous, margins smooth.

Found in mud between tide marks, usually in inside waters.

Subgenus **GREGARIELLA**<sup>50</sup> Monterosata, 1883

**Modiolus opifex**<sup>51</sup> (Say)

Pl. 7, fig. 40

Alt., 7; length, 17 mm. Shell smooth save for growth lines, oval, attenuated to a rounded point posteriorly; shell light colored covered with brown epidermis; valves carinated to form a flat hinge area; epidermis fringed and ragged along the keel; interior pearly.

Dredged, taken from cavities in fragments of rock and coral.

Genus **BOTULA**<sup>52</sup> Mörch, 1853

**Botula castanea**<sup>53</sup> (Say)

Pl. 7, fig. 41

Alt., 6; length, 15 mm. Shell oblong, smooth, inflated, purplish beneath shining brown epidermis, purplish within; anterior margin rounded; posterior margin rounded; umbos high, subterminal; depressed byssal notch anterior to center.

Shallow and moderate depths.

**Botula fusca**<sup>54</sup> (Gmelin)

Pl. 7, fig. 42

Alt., 4; length, 12 mm. Shell oblong, smooth, inflated, dark-brown shining epidermis. Anterior extremity rounded; posterior extremity with high, rounded umbos, subterminal and almost in contact. Juvenile shells have a more or less rhomboidal outline.

Shallow to moderate depths.

Genus **LITHOPHAGA** Röding, 1798

**Lithophaga**<sup>55</sup> **antillarum** (d'Orbigny)

Pl. 40, figs. 289a, b

Alt., 12 or more; length up to 50 mm. Shell white with thick, dark-brown epidermis; much elongated oval, date-shaped; dorsal and ventral margins nearly parallel, anterior and posterior margins rounded; umbos suppressed; fine basal ribbing, growth lines most

<sup>50</sup> Lat., *gregarius*, belonging to the herd, common.

<sup>51</sup> Lat., *opifex*, an artificer.

<sup>52</sup> Lat., *botula*, a sausage.

<sup>53</sup> Lat., *castanea*, chestnut.

<sup>54</sup> Lat., *fuscus*, tawny.

<sup>55</sup> Gr., *lithos*, stone; *phagein*, to eat.



pronounced posteriorly; interior white.

This is a boring species. Sometimes found in lumps of coral on the beach, dredged in living coral and in rock from reefs.

**Lithophaga bisulcata**<sup>56</sup> (d'Orbigny)

Pl. 8, fig. 43

Alt., 11; length, 38 mm. Shell with polished brown epidermis, usually covered with a rough, brownish-colored calcareous coating; shell date-shaped; posterior margin smoothly rounded, but epidermis and its calcareous coating prolonged beyond the rounded shell margin to a blunt point. Umbos small, pointed, at anterior end of hinge margin. Each valve has two oblique sulcations directed posteriorly from dorsal margin. Interior brown.

Burrows in coral, rock, other shells, cement. Found in both shallow and deep water.

**Lithophaga aristata**<sup>57</sup> (Dillwyn)

Pl. 8, fig. 44

Alt., 14; length, 30 mm. Shell cylindrical, dull white, brittle, similar to *L. bisulcata* in shape and general character; no sulcation of valves; the posterior prolongations of the valves cross in a scissorlike manner. The mollusk burrows in coral.

Genus **MODIOLARIA** Beck, 1938

**Modiolaria**<sup>58</sup> *lateralis* (Say)

Pl. 8, fig. 45

Alt., 5.5; length, 12 mm. Thin, fragile, pale brown, with thin, shining epidermis; shell inflated, slightly carinate posteriorly. Umbos small, rounded, recurved; valves finely ribbed at each end with a smooth central area; margins serrate at ends of ribs, smooth with byssal notch between groups of serrations; pearly lining.

Usually attached to ascidians, in the crevices of zoöid colonies, on shells such as *Atrina*.

Order **ANOMALODESMACEA** <sup>59</sup>

Family **PERIPLOMATIDAE**

The east American genera of the Periplomatidae are distributed along the coast from Labrador to Florida and the West Indies. The

<sup>56</sup> Lat., *bis*, twice; *sulcare*, to furrow.

<sup>57</sup> Lat., *arista*, arm.

<sup>58</sup> Lat., *modiolus*, with suffix *arius* to form generic name.

<sup>59</sup> Gr., *anomalos*, uneven; *desmos*, band or ligament.

shells are all white and fragile. The most interesting character of the Periplomas is the existence of a small triangular-shaped lithodesma which is within the shell and lies between the spoon-shaped tooth and the anterior cardinal margin. The mollusks are hermaphroditic.

Genus **PERIPLOMA** Schumacher, 1817

**Periploma**<sup>60</sup> *inaequivalve* Schumacher

Pl. 8, fig. 46

Alt., 8.5; length, 14 mm. Shell light and fragile, white; inequivalve, left valve smaller; inequilateral, posterior extremity truncated and a little gaping; umbos small, near posterior extremity and directed posteriorly; an oblique ridge or keel from umbo to posterior end of ventral margin; concentric growth lines; interior pearly; one spoon-shaped tooth in each valve for the reception of hinge cartilage.

Found in sand bottoms near low tide mark. Preyed upon by *Marginella apicina*.

#### Family **PANDORIDAE**

Distribution of the Pandoridae is quite general in all seas. On the East American coast they are found from the Arctic Ocean to the Gulf of Mexico.

The shells are small and usually free; inequivalve; roughly semilunar; white or brownish with a thin periostracum. The umbos are inconspicuous and the hinge consists of lamelliform plates which take the place of teeth, and an internal ligament lodged in an oblique sulcus. There is a lithodesma. Non-byssiferous.

Genus **PANDORA** Chemnitz, 1795

**Pandora**<sup>61</sup> *trilineata* Say

Pl. 8, figs. 47a, b

Alt., 15; length, 29; diam., 3.5 mm. Shell white, smooth, growth lines parallel with ventral margin; thin, light-colored, polished epidermis; slightly inequivalve; inequilateral; umbos at extreme anterior end, not projecting; hinge internal, below umbos, lamellar plates replace teeth; a ligamentary fossa is present. Posterior part of shell much prolonged, with a scimitar curve upward; posterior

<sup>60</sup> Gr., *peri*, around, about; *ploimos*, fit for sailing; *periplomenos*, moving.

<sup>61</sup> Gr., *pan*, all, *doron*, gift—*Pandora*, all-gifted, a mythological person.

margin flattened; anterior margin round, truncate; ventral margin rounded and prolonged; shell much narrowed toward posterior extremity; right valve flat, left convex, each with a narrow oblique ridge near anterior extremity; oval impressions of two adductor muscles, pallial line simple, discontinuous.

Dredged in two fathoms off Blind Pass, Sanibel Island.

Subgenus **KENNERLIA** Carpenter, 1864

**Pandora bushiana**<sup>62</sup> Dall

Pl. 9, fig. 48

Alt., 6; length, 14; diam., 1.5 mm. Shell white, smooth, delicate epidermis; right valve flat or concave, left valve convex; inequilateral, short and rounded anteriorly, prolonged posteriorly; umbos minute; anterior and ventral margins rounded; posterior margin extended, nearly straight; a linear demarcation between anterior and posterior portions of valves; slightly carinate behind; sculpture of growth lines; hinge typical; pearly interior, two muscle scars; indistinct, simple pallial line.

Dredged off Sanibel Island between four and six fathoms.

**Pandora arenosa**<sup>63</sup> (Conrad)

Pl. 9, fig. 49

Alt., 5.5; length, 12; diam., 1.5 mm. General features like *P. bushiana*; shorter; with ventral margin more convex. Right valve concave, with fine, radiating, engraved lines. Left valve convex, smooth.

Dredged in the Gulf with *P. bushiana*.

#### Family **LYONSIIDAE**

The family Lyonsiidae has genera in both the Atlantic and the Pacific oceans, most of them in deep water. Shells are small, fragile, and pearly. The lower west coast of Florida has two species of *Lyonsia*.

Genus **LYONSIA** Turton, 1822

**Lyonsia**<sup>64</sup> *floridana* Conrad

Pl. 9, fig. 50

Alt., 7.5; length, 16; diam., 5 mm. Shell fragile and translucent, pearly; thin papery epidermis; inequivalve, left larger, its

<sup>62</sup> Named for Katherine J. Bush.

<sup>63</sup> Lat., *arenosus*, sandy.

<sup>64</sup> Genus dedicated to the naturalist, W. Lyons.

umbo higher than its fellow; inequilateral, prolonged, narrowed, truncated and open posteriorly; umbos minute, pointed, in contact; dorsal margin concave behind umbos; shell surface shows incremental lines, with radiate wrinkles and marginal folds of the epidermis; hinge without teeth, a small submarginal groove for ligament and lithodesma posterior to umbos; interior pearly, two muscular impressions, indistinct pallial line; delicate byssus.

Found in muddy bottom in shallow water.

**Lyonsia beana**<sup>65</sup> d'Orbigny

Pl. 9, fig. 51

Alt., 8; length, 23; diam., 9 mm. Shell pearly, smooth; brownish, radiately striate epidermis; shape irregular, inequivalve, inequilateral, prolonged and widened behind; posterior margin rounded, gaping; umbos anterior, small, close; hinge and interior typical.

Found in deeper water than *L. floridana*, frequently in sponge or attached by delicate byssal threads to other shells.

#### Family CUSPIDARIIDAE

Most members of the family Cuspidariidae are inhabitants of profound depths; they are native to all seas, but are seldom seen except with dredged material. The shells are small, white, with thin epidermis; pyriform; slightly inequivalve, left valve larger and of greater convexity; inequilateral, round and inflated anteriorly, posterior portion beaked, gaping. There is an external linear ligament, and an internal cartilage placed in a small spoon-shaped fossette. Hinge teeth variable; two muscle scars; pallial line has small sinus.

Genus CUSPIDARIA Nardo, 1840

Subgenus CARDIOMYA A. Adams, 1864

**Cuspidaria**<sup>66</sup> *gemma* (Verrill and Bush)

Pl. 9, fig. 52

Alt., 3.5; length, 6 mm. Shell fragile, thin, white; smooth epidermis; delicate concentric growth lines; four radiate ribs—one almost in center of shell, three posterior to center; rounded ventral margin, angulated termination of ribs; posterior end of shell prolonged; right valve has one lateral tooth.

Dredged at one to two fathoms in blue mud.

<sup>65</sup> A. S., *bean*, from a Gothic word meaning to puff up.

<sup>66</sup> Lat., *cuspidis*, pointed end; *gemma*, a bud.

Order TELEODESMACEA<sup>67</sup>Family CYRENIDAE<sup>68</sup>

In general the Cyrenidae are fluviatile and brackish water mollusks. Most abundant in temperate regions.

## Genus POLYMESODA Rafinesque, 1820

## Subgenus PSEUDOCYRENA Bourguignat, 1855

**Polymesoda**<sup>69</sup> *floridana* (Conrad) Pl. 9, fig. 53

Alt., 17; length, 21 mm. Shell and margin rounded, smooth, lusterless, thin epidermis; white to purple, often banded in the two colors; umbos rounded, near together; hinge with three cardinal and two lateral teeth; interior smooth, colored like exterior; two muscle scars, simple pallial line.

Found on tidal flats and in bayous.

**Polymesoda** *floridana protexta*<sup>70</sup> (Conrad) Pl. 9, fig. 54

Similar to *P. floridana*, longer, slightly keeled posteriorly, ventral margin has posterior sinuosity.

Family GOULDIIDAE<sup>71</sup>

The family Gouldiidae is generally distributed through all seas. Species of the genus *Crassinella* are found from New England southward to the West Indies and in the Gulf of Mexico.

## Genus CRASSINELLA Guppy, 1874

**Crassinella** *mactracea*<sup>72</sup> (Linsley) Pl. 9, figs. 55a, b

Alt., 8; length, 9 mm. Shell small, flattened, triangular, equi-valve, thin epidermis; brownish red with darker brown; flattened, concentric ribs; umbos apical; two cardinal teeth in left valve, one in right valve; two lateral teeth in each valve; interior smooth, often two broad purple rays; two muscle impressions; simple pallial line; smooth margins.

From less than one to six fathoms.

<sup>67</sup> Gr., *teleos*, complete; *desmos*, band, ligament.

<sup>68</sup> Gr., *Cyrene*, a nymph.

<sup>69</sup> Gr., combining form *poly*, many, and *meso*, in middle.

<sup>70</sup> Lat., *pro*, before and *textus*, structure.

<sup>71</sup> Named for A. A. Gould, M.D., naturalist.

<sup>72</sup> Gr., *maktra*, a kneading trough.

Family **CARDITIDAE**

The Carditidae are native to northern, temperate, and warm seas and to moderate depths. All have solid equivalve shells, usually ribbed.

Genus **CARDITA** Bruguière, 1792

**Cardita**<sup>73</sup> *floridana* (Conrad)

Pl. 10, fig. 56

Alt., 24; length, 38; diam., 20 mm. Shell solid, heavy; porcelainous; creamy ground color, maculations of brown; sand-colored epidermis; equivalve; inequilateral, oval, longest posteriorly; umbos small, umbonal region high, curved inward; small, depressed lunule; 15 to 18, strong radiating ribs, lamellated or beaded by transverse growth lines—less prominent in intercostal spaces; external hinge ligament; hinge oblique, strong cardinal teeth, right valve has one anterior lateral, left valve one posterior lateral tooth; interior pure white, smooth; two muscular impressions and simple pallial line well impressed; margins dentate corresponding to ribs.

Found in the bays, where specimens are more uniformly dark-colored and less thick than shells taken in the Gulf. From shallow water to four fathoms.

Genus **VENERICARDIA** Lamarck, 1801

Subgenus **PLEUROMERIS**<sup>74</sup> Conrad, 1867

**Venericardia** *tridentata*<sup>75</sup> Say

Pl. 10, fig. 57

Alt., 7; length, 6.3; diam., 4.5 mm. Shell rather thick, cordiform, light-brown irregular color markings; equivalve, almost equilateral; umbos small, round; small lunule; about 16 to 18 beaded, radiating ribs, no sculpture in intercostal spaces. Two cardinal teeth in left valve, separated by a triangular socket which receives single cardinal tooth of right valve. Interior purple; two muscle scars; simple pallial line; margins crenate.

Taken in three to seven fathoms.

<sup>73</sup> Gr., *kardia*, heart.

<sup>74</sup> Gr., *pleuro*, rib, side; *meris*, a part.

<sup>75</sup> Lat., *tri*, from *tres*, three; *dens*, tooth.

Subgenus **PTEROMERIS**<sup>76</sup> Conrad, 1862**Venericardia perplana**<sup>77</sup> (Conrad)

Pl. 10, fig. 58

Alt., 7; length, 6; diam., 2 mm. Shell small, obliquely trigonal; bluish gray with zigzag markings of brown; equivalve; inequilateral; 12 to 14 smooth radiate ribs which increase in width toward margin; umbos sharp; two cardinal teeth in left valve, one in right valve; interior purple-brown; two muscular impressions and simple pallial line; margins dentate within.

Dredged in one to seven fathoms.

Family **CHAMIDAE**

Members of the family Chamidae are native to warm and tropical seas. All have fixed, heavy, inequivalve shells with spiral umbos and an external ligament. Fixation by either the right or left valve is a generic character; the fixed valve is always deeper. Shells of Chamidae are frequently attacked by the burrowing sponge *Cliona* and are often mined by boring mollusks.

Genus **CHAMA** Linné, 1758**Chama**<sup>78</sup> **congregata** Conrad

Pl. 10, fig. 59

Alt., 25; length, 27 mm. Shell fairly thick, orbicular, attached by left valve which is larger and deeper than the upper valve and with its umbo well above ligamentary area. Umbos turn to right when shell is observed in its attached position. Area of attachment variable. On a flat surface it is apt to include almost entire lower valve. Sculpture of elevated, radiating ridges and more or less foliate lamellae along concentric growth lines; usually red, with colors deepest on ridges and foliations; there is also a pure yellow form. An external ligament which follows curve of the umbos; hinge with one heavy cardinal tooth in upper valve, opposite socket in lower valve; interior white with tinting of exterior color; two muscle scars, simple pallial line; margins finely crenate, closely approximate.

Found adhering to shells of *Atrina rigida*, *Arca zebra* and *A. notabilis* but rarely to other arks, and to dredged fragments of reef rock. Common on valves of *Atrina* on the beaches; dredged from one to seven fathoms.

<sup>76</sup> Gr., *ptero*, feather; *meris*, a part.

<sup>77</sup> Lat., *per*, prefix meaning completely, with *planus*, flat.

<sup>78</sup> Lat., *chama*, cockle; *congregare*, to congregate.

***Chama macerophylla*<sup>79</sup> Gmelin**

Pl. 10, fig. 60

Average alt., 40; length up to 90 mm. General characters those of *C. congregata*, but larger and heavier, valves deeper and without radiate ridges, and having the lamellar foliations fluted and more developed on both upper and lower valves. Color forms vary through shades of pink, yellow, and combinations of the two colors. Margins crenate within.

Frequently adherent to valves of *Atrina*.

Genus **PSEUDOCHEMA** Odhner, 1917

***Pseudochama*<sup>80</sup> *radians variegata* (Reeve)**

Pl. 10, fig. 61

Alt., 40; length, 35 mm. Attached by right valve; spiral twist of umbos to left when shell is viewed in attached position, umbos slightly more prominent than in *Chama*. Attachment to its support often by lamellar processes instead of a flattened valve surface. Sculpture of both ridges and foliations; internal margins finely crenate; other characters typical of family. *Pseudochama* is seldom attached to other shells.

Taken about reefs in four to seven fathoms.

Genus **ECHINOCHAMA** P. Fischer, 1887

***Echinochama*<sup>81</sup> *cornuta* (Conrad)**

Pl. 10, fig. 62

Alt., 40; length, 35 mm. Shell thick, globular, white with brown stains near umbos; equivalve; valves and umbo curve forward; wide, deeply impressed lunule. Each valve bears seven or eight strong ribs with erect, slender, tubular spines. Surface of both valves, including lunule, covered with beadlike papillae. Hinge ligament partly internal. Each valve has one cardinal tooth. Interior white or purple; two muscle scars, simple pallial line, margins scalloped and finely crenate. Juvenile shells are attached by a small area near right umbo; adults usually free.

Family **UNGULINIDAE**<sup>82</sup>

The Ungulinidae is a small family with close affinities to the

<sup>79</sup> Gr., *macro*s, long in extent, with *phyllon*, leaf.

<sup>80</sup> Gr., *pseudes*, false; Lat., *radians*, pres. part. of *radiare*, to emit rays; past part. of *variegare*, to variegate.

<sup>81</sup> Lat., *echinus*, hedge-hog; *arcus*, bow, *ella*, dim. suffix; *cornutus*, horned.

<sup>82</sup> Lat., *ungula*, claw, hoof.



Lucinidae. Their distribution is through northern seas almost to tropical waters.

The shells are equivalve, globose, the umbos prominent, directed forward. The hinge usually has two cardinal teeth in each valve, sometimes but one or none. Ligament internal or partly so. Two elongate muscle scars and simple pallial line.

Genus **TARAS** Risso, 1826

(*Diplodonta* Brown, 1831)

**Taras punctatus**<sup>83</sup> (Say)

Pl. 11, figs. 63a, b

Alt., 14; length, 15.5; diam., 10 mm. Shell lucinoid, thin, white, translucent; thin periostracum; umbos prominent, approximate; no lunule; anterior margin slightly concave immediately below umbo; surface of valves smooth, faint concentric striations and microscopic radial striae; two cardinal teeth in left valve, the anterior bifid; two in right valve, the posterior bifid. Interior of valves usually shows opaque, punctate spots most evident near umbonal region. Anterior and posterior muscular impressions; simple pallial line, often with slight irregularities. Pallial lines more removed from shell margin than are outer borders of the muscular impressions. Shell margins smooth.

Taken in depths of 6 to 125 fathoms.

Subgenus **PHLYCTIDERMA**<sup>84</sup> Dall, 1899

**Taras semiasperus**<sup>85</sup> (Philippi)

Pl. 40, fig. 290

Alt., 8.5; length, 8; diam., 5.5 mm. Shell small, white, globose; umbos small depressed. Opaque punctations over valve surfaces, on exterior of valves the opaque points are slightly elevated. Other characters correspond to *T. punctatus*.

Dredged in six fathoms.

#### Family **LUCINIDAE**

Mollusks of the family Lucinidae are generally distributed in subtropical and tropical seas. Only one genus has accommodated itself to the rigors of Arctic seas and to great depths. Their normal range is from the littoral region to deep water. The animal has a

<sup>83</sup> Taras, son of Neptune. Lat., *punctus*, point.

<sup>84</sup> Gr., *phlyktaiva*, pustule; *derma*, skin.

<sup>85</sup> Lat., *asper*, rough.

long slender foot well adapted for digging in sand and for moving from place to place.

Shells of the Lucinidae are round or lentiform, compressed, equi-valve and subequilateral. The umbos are small but definite and point forward; the lunule is small and clear-cut. The ligament is internal or semi-internal; hinge teeth are variable and the shell of some genera is edentulous. The interior of each valve shows two muscular impressions and a pallial line.

Genus **LUCINA** Bruguière, 1797

Subgenus **PSEUDOMILTHA** P. Fischer, 1887

**Lucina floridana** Conrad

Pl. 11, fig. 66

Alt., 36; length, 34 mm. Shell white, porcelanous, with thin, brownish, papery periostracum; orbicular, compressed, equi-valve, subequilateral; umbos small, pointed; lunule oval; sculpture of inequidistant concentric growth lines; hinge margin thick, edentulous; interior white; muscle scars and pallial line typical; wide, finely crenate border.

Common in shallow water.

Subgenus **LUCINISCA** Dall, 1901

**Lucina nassula**<sup>86</sup> Conrad

Pl. 11, fig. 65

Alt., 9.5; length, 10 mm. Shell small, white, rounded, almost equilateral; umbos small; lunule impressed; elegant reticulate sculptures of radiating ribs and about 20 concentric, lamellate ridges; cardinal and lateral teeth present; interior white, margins finely serrate.

Common in shallow water.

Genus **LINGA** de Gregorio, 1885

Subgenus **PARVILUCINA** Dall, 1901

**Linga**<sup>87</sup> **multilineata** (Tuomey and Holmes)

Pl. 40, fig. 291

Alt. 5.5; length, 5 mm. Shell small, round, solid, white, valves thick, thin epidermis; about 12 broad radiating ribs crossed by prominent concentric ridges; lunule impressed, not ribbed; umbos small; small cardinal and lateral teeth in right and left valves; inner margin finely crenate.

<sup>86</sup> Lat., *nassa*, a basket for catching fish.

<sup>87</sup> Lat., *multus*, many; *lineare*, to reduce to a straight line.

Found in sand and muddy bottom from shallow to deep water.

**Linga amiantus**<sup>88</sup> (Dall)

Pl. 11, fig. 67

Alt., 6.5; length, 6 mm. Shell small, white, globose; valves not thick, thin periostracum; lunule small, impressed; umbos in contact; delicate reticulate sculpture; small cardinal and lateral teeth; margins finely crenate.

Inhabits mud and sand bottom from shallow to deep water.

Subgenus **CAVILINGA** Chavan, 1937

**Linga trisulcata** (Conrad)

Pl. 45, fig. 312

Alt., 5; length, 4.5 mm. Shell chalky white, small, moderately convex, oblique, inequilateral; umbos high, approximate; surface finely, concentrically grooved, with two or three deeper concentric sulci, indicating resting stages; two cardinal teeth in left valve, one in right; lateral teeth small but distinct; inner margin minutely crenulate.

Dredged in four to six fathoms.

Genus **ANODONTIA** Link, 1807

**Anodontia**<sup>89</sup> **pectinata** (Gmelin)

Pl. 11, fig. 64

Alt., 55; length, 58 mm. Shell pale yellow, lenticular, thin periostracum; rostrate posteriorly, also a slight anterior rostration; umbos small, approximate; small lunule, not evenly halved between the two valves; margin rounded, smooth; sculpture of concentric, lamellate ridges and delicate parallel ribbing in interspaces; sub-marginal ligament; two cardinal teeth in left valve, one in right; one anterior and one posterior lateral in left valve; opposite sockets in right valve; interior yellow; narrow anterior and posterior muscle scars; inner margins finely crenate.

Inhabits muddy sand at no great depths.

**Anodontia alba**<sup>90</sup> Link (*Loripinus chrysostoma* Philippi)

Pl. 40, fig. 292

Alt., 50; length, 53 mm. Shell subglobose with rounded margins; exterior white, interior brilliant orange color, deepest near margins; umbos not prominent; hinge margin extended anteriorly to a faint

<sup>88</sup> Gr., *amiantos*, unstained.

<sup>89</sup> Gr., *ano*, without; *dontes*, teeth; Lat., *pectinare*, to comb.

<sup>90</sup> Lat., *albus*, dead white.

lunule; sculpture of growth lines; hinge edentulous; ligament bright scarlet in fresh specimens; margins smooth.

Inhabits sandy bottom at moderate depths.

**Anodontia philippiana** (Reeve) (*Loripinus schrammi* Crosse) Pl. 12, fig. 69

Alt., 70; length, 80; diam., 55 mm. Shell white, globose, brownish periostracum; umbos rounded, in contact, sometimes worn; strong, coarse, concentric growth lines; hinge edentulous, ligament strong, brown; interior surface of valves rough, anterior muscular impression transversely elongate; margins smooth.

Inhabits moderate depths.

Genus **CODAKIA** Scopoli, 1777

Subgenus **CTENA** Mörch, 1861

**Codakia orbiculata**<sup>91</sup> (Montagu)

Pl. 11, fig. 68

Alt., 11; length, 12 mm. Shell small, white, obliquely rounded—not globose, thin periostracum; lunule small; umbos in contact; sculpture of numerous radiating ribs, some bifid, and some intercalation of riblets near margin; fine concentric lines and coarser growth lines cross ribs; small cardinal and lateral teeth.

A shallow water species, found in sand.

Family **LEPTONIDAE**<sup>92</sup>

Mollusks of the family Leptonidae have small shells. They are usually thin and somewhat translucent, equivalve, with a tissue-like periostracum. Most of its genera are viviparous.

Genus **ERYCINA** Lamarck, 1806

**Erycina**<sup>93</sup> **floridana** Vanatta

Pl. 12, figs. 70a, b

Alt., 5.25; length, 7.5; diam., 2 mm. Shell small and symmetrical, white, translucent and fragile; flattened, equivalve, subequilateral; umbos sharp, small but distinct; anterior and posterior margins evenly rounded, dorsal margin slightly convex, ventral margin almost straight; concentric sculpture of delicate growth lines with coarser lines at intervals; hinge has small fossette below umbos,

<sup>91</sup> Lat., *orbis*, orb, rounded.

<sup>92</sup> Gr., *leptos*, small, delicate.

<sup>93</sup> *Erycina*, a name for *Venus*.

one divergent cardinal tooth, one anterior and one posterior lateral tooth. Two oval muscular impressions and simple pallial line.

Dredged in five fathoms.

#### Family CARDIIDAE

The Cardiidae are mollusks native to all seas, living in sand at moderate depths. Some genera are strictly marine, others are adapted to brackish water. A long, geniculate foot and two large siphons are prominent characters.

The shells are equivalve, variable in shape and sculpture, but all are cordiform when observed from either end. All have a periostracum, an external ligament, cardinal teeth, simple pallial line, and serrate or crenate margins.

#### Genus TRACHYCARDIUM Mörch, 1853

**Trachycardium**<sup>94</sup> *egmontianum* (Shuttleworth)

Pl. 12, fig. 71

Alt., 55; length, 84 mm. Shell subequilateral, light color spotted with brown, thin epidermis; umbos round, approximate; about 30 radiating ribs, all bearing short, sharp, semierect, curved processes; cardinal and lateral teeth present; interior smooth, handsomely colored in shades of salmon-pink and purple; margins deeply serrate, interlocking; albino specimens are not uncommon.

**Trachycardium** *muricatum*<sup>95</sup> (Linné)

Pl. 12, fig. 72

Alt., 44; length, 38 mm. Shell with general characters of *T. egmontianum*; yellowish with irregular maculations of brown; about 32 ribs, 10 or 12 central ribs almost or quite smooth, others strongly spinose; interior yellow.

#### Genus DINOCARDIUM Dall, 1900

**Dinocardium** *robustum*<sup>96</sup> *vanhyningi* Clench and Smith

Pl. 12, fig. 73

Alt., 110; length, 82 mm. Shell large, robust, oblique, yellowish brown irregularly maculated with reddish brown; posterior area flattened, dark and polished; umbos rounded, approximate, the opposed surfaces frequently worn smooth; about 35 strong, flat ribs;

<sup>94</sup> Gr., *trachys*, rough, rugged; *kardia*, heart.

<sup>95</sup> Lat., *muricatus*, from murex, a pointed rock or stone.

<sup>96</sup> Gr., *deinos*, huge, mighty; Lat., *robustus*, hard, strong.

stout external ligament; one cardinal tooth in each valve, with two anterior lateral and one posterior lateral in right valve and a contrary arrangement in left valve; interior reddish brown; margins serrate.

Genus **PAPYRIDEA** Swainson, 1840

**Papyridea soleniformis**<sup>97</sup> (Bruguère) (*P. spinosum* Meuschen) Pl. 13, fig. 74

Alt., 28; length, 35 mm. Shell thin, transversely elongate, gaping at posterior end; ground color light mottled with rosy brown; brownish periostracum; pure yellow specimens occur; numerous low, flat ribs, smooth over central area, slightly spinose over anterior portion, sharply spinose posteriorly and prolonged beyond the gaping margin; cardinal and lateral teeth; interior pinkish, sometimes rayed with darker shade.

Genus **TRIGONICARDIA** Dall, 1900

**Trigoniocardia**<sup>98</sup> *media* (Linné)

Pl. 41, fig. 293

Alt., 32; length, 28 mm. Shell inequilateral, semirounded, creamy white, splotted with brown; darkest on posterior side which is flat heart-shaped; anterior side, round heart-shaped; umbos high and semirounded; 22 serrated ribs on rounded anterior slope, 12 smoother ribs on posterior, flat heart-shaped slope; margin moderately serrated, closely interlocking; interior white.

Genus **LAEVICARDIUM** Swainson, 1840

**Laevicardium laevigatum**<sup>99</sup> (Linné) [*L. serratum* (Linné)] Pl. 13, fig. 75

Alt., 65; length, 54 mm. Shell oblique posteriorly downward, of alabasterlike quality, ivory color, brown or ashen epidermis; umbos round; traces of narrow ribs; cardinal and lateral teeth; interior cream color, often pinkish; internal margins finely serrate.

**Laevicardium mortoni** (Conrad)

Pl. 13, figs. 76a, b

Alt., 16; length, 15 mm. Shell small, thin, smooth, inflated, nearly round; cream color irregularly patterned with brown; umbos round, flat; faint concentric striations, minutely papillose; interior

<sup>97</sup> Lat., *papyrus*, paper; *soleniforma*, like a solen; *spina*, thorn.

<sup>98</sup> Gr., *trigonos*, three-cornered, triangular; *Kardia*, heart.

<sup>99</sup> Lat., *laevis*, smooth; Lat., *serra*, a saw.

yellow with more or less brown, conspicuously dark at posterior border; internal margins finely crenate.

***Laevicardium pictum***<sup>100</sup> (Ravenel)

Pl. 41, fig. 294

Alt., 14 mm., length 12 mm. Shell small, thin, oblique toward posterior angle, moderately inflated; cream-colored, with zigzag cocoa-colored markings; inside a light cream or white, the outer markings showing through the shell; umbos small and low, toward the anterior of the valves; faint concentric ribs, which show up more on the inside than the outside; internal anterior margin and a short space on the extreme oblique margin are slightly crenate.

#### Family VENERIDAE

The Veneridae have claim to distinction beyond any others of the pelecypods. The name, from the goddess Venus, suggests the elegance of form and color for which shells of this tribe are remarkable, and as if grace and beauty of form or color were not enough, many of them are elaborately sculptured as well.

The Veneridae first appeared in remote geologic ages, while in Recent times this family has attained the culmination of pelecypod development. It is now the largest pelecypod family in number of genera and species, and of widest distribution in depth and range. They are native to all seas, and wherever man has found them, he has taken the animals for food and the shells for use and ornament. In ancient times, the shells of a Mediterranean species were worn as an emblem of Aphrodite, and among some South Sea tribes, shells of other species are now worn as personal adornment with the same symbolism.

The animals are burrowers but do not dig deeply into the sand and are never fixed; they move about freely by means of a flattened tongue-shaped foot.

Shells of most genera of the Veneridae are of a graceful rounded oblong or oval form, equivalve, frequently marked with chevron-shaped lines of brown on a white surface, and distinctly ribbed or grooved along the lines of growth. Some are cancellated by radiate

<sup>100</sup> Lat., *pictum*, ornate, artistic.

ribbing. There are three diverging cardinal teeth in each valve, with variable lateral teeth, and duplex muscular impressions. They are solid, porcelaneous in texture, sometimes heavy.

Some of the smallest and some of the largest bivalves belong to this family.

Genus **DOSINIA** Scopoli, 1777

Subgenus **DOSINIDIA** Dall, 1902

**Dosinia**<sup>101</sup> *elegans* (Conrad)

Pl. 13, fig. 77

Alt., 63; length, 72 mm. Shell orbicular, flattened, ivory color; transparent, brownish periostracum; prominent umbos, curved forward; small lunule; sculpture of regular, alternating ribs and grooves; hinge margin thick, ligament partly submarginal; cardinal and lateral teeth present; pallial sinus oblique and angulate; margins smooth.

*Dosinia discus* (Reeve) is occasionally found north of Tampa and may be distinguished from *D. elegans* by its finer and closer concentric striation and its more compressed form.

Genus **TRANSENELLA** Dall, 1883

**Transenella**<sup>102</sup> *conradiana* Dall

Pl. 13, fig. 78

Alt., 9; length, 17; diam., 4.5 mm. Shell small, smooth, rounded rostrate and extended at posterior end. White with fine zigzag markings of pale brown, often purple at posterior end; thin periostracum; lunule well defined, escutcheon obscure. Three cardinal teeth in each valve, middle right tooth bifid; one left posterior lateral tooth with opposite socket in right valve; interior polished, white, washed with yellow or pink, purple at posterior end; pallial sinus oblique with rounded extremity.

Characteristic of the genus *Transenella* is a series of grooves on inner aspect of the slightly bevelled valve margins. These grooves cut diagonally across the line of growth and may be best observed with magnifying lens.

**Transenella cubaniana** (d'Orbigny)

Pl. 13, fig. 79

Alt., 8.5; length, 11; diam., 4.5 mm. Shell pure white, rarely flecked with brown; trigonal, less rostrate than *T. conradiana*. Sculpture of fine impressed, concentric lines; inner margin obliquely engraved.

<sup>101</sup> N. Lat., *dosin*, a species of Senegal, Africa.

<sup>102</sup> Lat., *transennae*, net, lattice.





Fig. 2. Diagram showing the characteristic features of *Transenella*.

***Transenella stimpsoni* Dall**

Pl. 13, fig. 79a

Alt., 9.5; length, 13; diam., 6 mm. Shell small, trigonal, rounded, moderate posterior rostration; milky white or bluish color with brown streaks and chevron markings; umbos prominent, a little anterior to middle; smooth, oval lunule, defined by an incised line; sculpture of fine concentric grooves; hinge typical, interior white to purple, polished; pallial sinus extends to middle of valve; inner margin obliquely engraved.

Genus **GAFRARIUM** Röding, 1798

***Gafrarium*<sup>103</sup> *cerina* (C. B. Adams)**

Pl. 13, fig. 80

Alt., 10.5; length, 13; diam., 4 mm. Shell small, flattened, trigonal, waxy cream color with zigzag pencillings of light brown; umbos small, acute, almost central; fine concentric striations and radiate striae over anterior and posterior areas; hinge with three cardinal and one anterior lateral tooth in each valve; interior polished, white, purple-tinted in umbonal region; pallial line with slight posterior sinuation; margins smooth.

Genus **MACROCALLISTA** Meek, 1876

***Macrocallista*<sup>104</sup> *nimbosa* (Solander)**

Pl. 13, fig. 81

Alt., 60; length, 115 mm. Shell smooth, thick, inequilateral, elongate oval, pink-tinted fawn color with radiate block-patterned bands of darker shade; thin, glossy epidermis; umbos depressed, long external ligament; lunule impressed, oval, purplish. Faint con-

<sup>103</sup> Gr., root *kop*, to take, grasp; Lat., *capere*, to take; Spanish, *gaffa*, hooking; *cerinus*, wax-colored.

<sup>104</sup> Gr., *macro*, long in extent; *Callista*, a nymph; Lat., *nimbus*, rain cloud.

centric and radiate striations; hinge typical; interior smooth, salmon-pink; pallial sinus reflected, wide at base, angular at tip; smooth margins.

These mollusks live buried in sand just beyond low water mark. They lie obliquely to the surface with the location of the burrow marked by a broad slit in the sand. Gulls and terns dig out and devour them in large numbers.

**Macrocallista maculata**<sup>105</sup> (Linné)

Pl. 13, fig. 82

Alt., 50; length, 52 mm. Shell smooth, rounded, moderately thick, translucent, inequilateral; fawn color with irregular maculations of brown; thin, glossy periostracum; umbos small; lunule small, impressed; interior polished, white, coloration often shows through; pallial sinus long and rounded; margins smooth. Other features typical.

Genus **PITAR** Römer, 1857

**Pitar**<sup>106</sup> *simpsoni* (Dall)

Pl. 14, fig. 83

Alt., 14; length, 14; diam., 8 mm. Shell small, white, rounded, inequilateral, thin periostracum; umbos small, prominent; lunule defined, but not the escutcheon; fine concentric striations; interior polished, white or purple; pallial sinus slightly ascending, rounded at extremity; margins smooth.

Shells of this genus have a groove within the margin of right valve posterior to the hinge and a similar groove in the left valve margin anterior to the hinge.

**Pitar fulminata**<sup>107</sup> (Menke)

Pl. 14, fig. 84

Pl. 41, fig. 295

Alt., 14; length, 15 mm. Shell similar to *P. simpsoni*, though slightly more rostrate. Ground color white with radial zigzag pencillings of bright brown, periostracum chalky.

Sandy bottom from low-water mark to 25 fathoms.

Genus **CYCLINELLA** Dall, 1902

**Cyclinella**<sup>108</sup> *tenuis* (Récluz)

Pl. 14, fig. 85

Alt., 24; length, 24.5; diam., 14 mm. Shell white, translucent,

<sup>105</sup> Lat., *macula*, a spot or stain.

<sup>106</sup> *Pitar*, a word of African vernacular.

<sup>107</sup> Lat., *fulminatus*, from *fulminare*; to strike with lightning.

<sup>108</sup> Gr., *kylos*, a circle; *ella*, dim. suffix; Lat., *tenuis*, thin.

orbicular, moderately thin, delicate periostracum; umbos small, directed forward; concentric growth lines and fine striations; submarginal hinge ligament; cardinal teeth typical; interior white, pallial sinus ascending, rounded extremity; margins smooth.

Genus **CHIONE** Megerle von Mühlfeld, 1811

**Chione**<sup>109</sup> *cancellata* (Linné)

Pl. 14, fig. 86

Alt., 33; length, 38; diam., 18 mm. Shell rounded, inequilateral, posterior margin lengthened and convex; anterior margin short, slightly concave; cream color or grayish with zigzag pencillings or triangular patches of brown; umbos round, not prominent; lunule well impressed with brown markings; escutcheon smooth, excavated, marked with brown lines; strongly lamellate concentric sculpture crossing rounded radiating ribs, the lamellae separated by interspaces about four and twenty-five hundredths millimeters wide. Interior smooth, yellow, purple or a combination of the two colors. Pallial sinus short, angular; inner margins crenate; other features typical.

**Chione** *intapurpurea*<sup>110</sup> Conrad

Pl. 14, fig. 87

Alt., 30; length, 35; diam., 21 mm. Shell with shape and general characters of *C. cancellata*; deep cream color with heavy angular markings of brown; ventral margin strongly convex; lunule impressed, brown; escutcheon almost flat, brown; many close, rounded, concentric ribs, somewhat lamellate anteriorly, strongly lamellate over posterior area. Not all ribs extend to margins of lunule and escutcheon; radial sculpture of impressed lines which do not cross ribs but are well defined in interspaces and on lateral aspects of ribs. Interior smooth, purple—deepest near posterior border and muscle scars; inner margin crenate; other characters typical.

This *Chione* is preyed upon by a purplish-colored, five-armed starfish; several other species of starfish are taken coincidentally but none have been observed to attack this clam.

Dredged in three to six fathoms on gravelly bottom.

<sup>109</sup> Lat., *Chione*, a mythological personage; *cancellatus*, latticed.

<sup>110</sup> Lat., *inter*, within; *purpura*, a purple dye.

**Chione granulata**<sup>111</sup> (Gmelin)

Pl. 41, fig. 296

Alt., 21; length, 24; diam., 12 mm. Shell with characters of the genus. Yellowish-cream color with four radiating bands of purple brown; squarish spots and indefinite dark markings; thin epidermis; umbos small; lunule small, ribbed; numerous radiate ribs of curious structure; posterior side of each rib rises to an angle of about 45 degrees from plane of valve surface to meet the anterior elevation of rib which rises at an angle of about 15 degrees; crest of rib is sharply angled. The angular ribs are cancellated by closely, impressed sulcations; sculpture less pronounced in central area; interior purple. Margins plicate in accord with ribs.

**Chione grus**<sup>112</sup> Holmes

Pl. 14, fig. 88

Alt., 7; length, 10; diam., 5 mm. Shell small, transversely oblong, inequivalve, grayish white with brown pencillings, a broad ray of purplish brown at posterior border; thin epidermis, shaggy at posterior margin; small lunule, brown; obscure escutcheon; surface cancellated by radiate and concentric ribbing. Interior white, deep purple at posterior border; pallial sinus oblique, angular; margins finely crenate.

The animal has two united, henna-colored, fringed siphons.

Genus **MERCENARIA** Schumacher, 1817**Mercenaria**<sup>113</sup> **campechiensis**<sup>114</sup> (Gmelin) [*Venus campechiensis* Gmelin]

Pl. 14, fig. 89

Alt., 100; length, 110 mm. represents size of average adult shell, individuals attain much greater dimensions and considerable weight; shell grayish white, heavy, thick, solid and porcelaneous; inequivalve; umbos far forward; strong external ligament; lunule and escutcheon well defined; margins rounded; sculpture of close, lamellar, concentric ridges; hinge margin thick, with strong cardinal teeth and a rugose area in each valve; interior smooth, white, often violet color at anterior and posterior margins; pallial sinus small, angular; inner margins crenulate.

**Mercenaria campechiensis** (Gmelin). Juvenile

Pl. 14, fig. 90

<sup>111</sup> Lat., *granum*, grain.<sup>112</sup> Gr., *grus*, *griers*, gritty, granulose.<sup>113</sup> Lat., *mercenarius*, reward, money.<sup>114</sup> From Campeche, Mexico.

Genus **ANOMALOCARDIA** Schumacher, 1817**Anomalocardia**<sup>115</sup> **euneimeris**<sup>116</sup> (Conrad)

Pl. 14, fig. 91

Alt., 12; length, 18; diam., 8.5 mm. Shell small, lengthened and rostrate posteriorly; vari-colored from pure white through shades of brown and green with brown lineations; smooth glossy periostracum; umbos small, lunule distinct, esutcheon depressed; prominent rounded concentric ridges and suggestions of radiate lines, external ligament; interior light purple at posterior margin; pallial sinus small, angular; inner margins crenate.

Genus **PARASTARTE** Conrad, 1862**Parastarte**<sup>117</sup>**triquetra**<sup>118</sup> (Conrad)

Pl. 14, fig. 92

Alt., 4; length, 2.75; diam., 2.5 mm. Shell minute, trigonal, equilateral; white or purple with glossy epidermis; umbos high, umbonal region inflated; small lunule, no escutcheon; fine concentric striations; interior purple or white; pallial line sinuous, margins crenate.

Family **PETRICOLIDAE**

All members of the family Petricolidae are burrowing mollusks. Most of them make for themselves increasingly larger cavities in hard clay, coral, or calcareous rock until adult size is attained.

Two siphons provide for in- and out-flowing currents of sea water bearing food and oxygen.

Distribution is general through warm seas.

The shells are oval-elongate, slightly gaping behind, with an external ligament and two or three cardinal teeth, no laterals; two muscular impressions and a definite pallial sinus.

Genus **PETRICOLA** Lamarck, 1801**Petricola lapicida**<sup>119</sup> (Gmelin)

Pl. 15, fig. 93

Alt., 20; length, 21 mm. Shell white, rounded, oblique toward posterior angle, thin periostracum; umbos round, recurved; sculpture

<sup>115</sup> Lat., *anomalus*, uneven.<sup>116</sup> Lat., *cuneus*, a wedge.<sup>117</sup> Gr., prefix, *para*, beside; *Astarte*, a genus of mollusks.<sup>118</sup> Lat., *triquetrus*, having three sides.<sup>119</sup> Lat., *petra*, stone; *colere*, to inhabit; *lapis*, rock; *cida*, suffix meaning a killing.

of fine zigzag striations and concentric growth lines; roughened wavy ridges over posterior area; external ligament extends under umbos; interior white, polished; small, pointed pallial sinus.

Genus **RUPELLARIA** Fleurian, 1802

**Rupellaria typica**<sup>120</sup> (Jonas)

Pl. 15, fig. 94

Alt., 20; length, 25 mm. Shell rough, white, rather thick, unequally rounded, inequilateral, prolonged and gaping posteriorly; thin periostracum; umbos rounded, not prominent, curved forward. About 40 rounded, elevated ribs, much narrower over anterior area; one strong cardinal tooth in right valve, two in left; interior white; shallow, rounded pallial sinus; margins smooth within, crenate without.

Genus **CORALLIOPHAGA** Blainville, 1824

**Coralliophaga**<sup>121</sup> **coralliophaga** (Gmelin)

Pl. 15, fig. 95

Alt., 13.5; length, 25 mm. Shell thin, white, rounded-oval; thin, papery epidermis; umbos inconspicuous, near anterior extremity; surface finely ribbed except over upper anterior area; growth lines lamellate posteriorly; interior white, smooth; shallow, pointed pallial sinus; margins delicate, crenate.

The animal lives in burrows of other mollusks, sometimes several in one cavity, and occasionally with the original owner.

Family **TELLINIDAE**

The "tellins" are remarkable for the length and mobility of their slender, delicate siphons, and the long and powerful foot. They bury themselves to a greater depth in sand than most other pelecypods and are able to retract the siphons entirely within the shell.

Some 500 species are known and the family is represented in all seas.

The shells are usually equivalve, flattened, rounded in front of umbos, more or less pointed and rostrate behind. The umbos are small and inconspicuous. The external ligament is strong and prominent, teeth variable. The shells of many species are beautifully colored and polished and many are finely sculptured.

<sup>120</sup> Lat., *rupes*, rock; *typica*, type.

<sup>121</sup> Coral; Gr., *phagein*, to eat.

Genus **TELLINA** Linné, 1758**Tellina**<sup>122</sup> *interrupta* Wood

Pl. 15, fig. 96

Alt., 25; length, 48 mm. Shell flattened, rounded in front; posterior portion is rostrate, truncate and bent toward the right from plane of shell; umbos suppressed, almost median; ligament external, posterior to umbos; color grayish suffused with lavender and pale brown with angular pencillings of brown; strong, elevated, concentric sculpture; two cardinal teeth and two lateral plates in each valve; interior polished, yellowish, with white, translucent border; pallial sinus deep, rounded; inner margins finely crenate.

**Tellina lineata**<sup>123</sup> Turton

Pl. 15, fig. 97

Alt., 14; length, 30 mm. Shell flattened; white or pink; white form has an anterior epaulette of pink; surface iridescent, with numerous, minute concentric striations, thin epidermis; umbos small, sharp; ventral and anterior margins rounded, posterior portion wedged-shaped, slightly flexuous, margin almost straight; color of interior and exterior alike; a wide, confluent pallial sinus almost touches anterior muscle scar; margins smooth.

The two forms are found together in sandy bottoms.

Subgenus **ARCOPAGIA** (Leach MS.) Brown, 1827**Tellina linteata**<sup>124</sup> Conrad

Pl. 15, fig. 98

Alt., 8; length, 18.5 mm. Shell small, flattened, white, anterior and ventral margins rounded; posterior area rostrate; margin straight, truncate; umbos pointed, a little behind center; concentric sculpture of delicate slightly lamellar ridges; cardinal and lateral teeth in right valve, cardinals only in left; interior smooth, muscular impressions polished; pallial sinus rounded, confluent; margins thin, smooth.

**Tellina alternata**<sup>125</sup> Say

Pl. 15, fig. 99

Alt., 27; length, 45 mm. Shell flattened, rounded anteriorly, slightly narrowed and keeled posteriorly; umbos pointed, not prominent; external ligament; sculpture of concentric, deeply impressed

<sup>122</sup> Gr., *telline*, a kind of shellfish; Lat., *interrumpo*, interrupted, continuity broken.

<sup>123</sup> Lat., *linea*, line.

<sup>124</sup> Lat., *linteus*, linen. -

<sup>125</sup> Lat., *alternare*, to alternate.

sulci, equidistant and parallel; every alternate sulcus disappears at angle of keel; quality of shell is translucent, showing the yellow and pink lines of the highly polished interior; thin glossy periostracum; three cardinal teeth in right valve; interior shows rays of deeper color near anterior and posterior borders, and a linear callus thickening behind anterior muscle scar; smooth margins.

Subgenus **MOERELLA** P. Fischer, 1887

**Tellina martinicensis**<sup>126</sup> d'Orbigny

Pl. 42, fig. 299

Alt., 8.5; length, 10.5; diam., 5.25 mm. Shell small, white and smooth within and without, epidermis pale brownish, thin, wrinkled; umbos acute, ligament inconspicuous; anterior margin straight near umbo, rounded below; ventral margin convex; posterior margin straight near umbo, suddenly sloping to posterior angle; slight posterior rostration; anterior and posterior lateral teeth in each valve, distant from umbo.

Subgenus **ANGULUS**<sup>127</sup> Megerle von Mühlfeld, 1811

**Tellina magna**<sup>128</sup> Spengler

Pl. 41, fig. 297

This is the largest of the Atlantic Tellinas. It reaches a length of 75 mm. The shell is smooth, flattened, the upper valve broadly rayed with yellow, lower valve white with yellow tint near umbo. Umbos small, posterior to middle; anterior portion longer and rounded, narrow and angulated posteriorly.

**Tellina agilis**<sup>129</sup> Stimpson (*T. tenera* Say)

Text fig. 3

Alt., 8; length, 13 mm. Shell small, inequilateral, polished, thin and pellucid, white or pinkish, iridescent, delicate concentric striations and thin epidermis; small umbos posterior to center; prominent external ligament; margins rounded at anterior, shorter at posterior with nearly straight edge; two cardinal teeth in each valve; anterior laterals developed, posterior weak; interior smooth; large rounded, confluent pallial sinus which almost extends to

<sup>126</sup> *martinicensis*, of Martinique.

<sup>127</sup> Gr., from the root *agcho*, angled.

<sup>128</sup> Lat., *magnus*, great.

<sup>129</sup> Lat., *agilis*, light, easily moved; *tener*, tender.



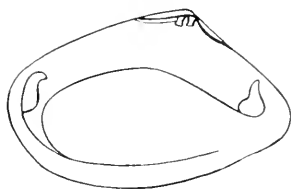


Fig. 3. *Tellina agilis* Stimpson

anterior muscular impression; margins smooth.

***Tellina versicolor*<sup>130</sup> Cozzens**

Pl. 41, fig. 298

Alt., 8.25; length, 17 mm. Shell small, white, iridescent, sometimes rayed with pink; striated with fine growth lines; inequivalve, shorter and slightly rostrate posteriorly; umbos not prominent; dorsal margin concave posterior to umbos; external ligament; yellow brown; hinge with strong right anterior lateral tooth; interior polished, iridescent, engraved with extremely fine, radiate striations; pallial sinus confluent to within .75 mm. of anterior muscular impression.

***Tellina sayi* Dall**

Pl. 42, fig. 300

Alt., 9; length, 14 mm. Shell small, white, opalescent, sometimes shows iridescence and concentric striation; post-umbonal margin straight, ligament yellow brown; posterior angular acute; anterior lateral tooth flattened; interior white, polished; pallial sinus confluent, tip 1 mm. from anterior muscle scar.

***Tellina rubricata*<sup>131</sup> L. Perry**

Pl. 42, fig. 301

Length, 8; width, 4.1 mm. Shell small, thin, slightly translucent, with delicate glossy epidermis; oval, rostrate and moderately attenuated posterior to the small umbos. Its color is pale pink with rays and extremely minute pencillings of deeper pink, the tint becoming paler toward the margin, with the widest and most deeply colored ray over the posterior rostration. The valves are sculptured

<sup>130</sup> Lat., *versicolor*, *versare*, to change with; *color*, color.

<sup>131</sup> Lat., *rubricatus*, marked with red.

with fine, closely placed, equidistant, concentric threads, continuous over rostrum to the posterior border, with some intercalation of threads at the umbonal ridge; the interspaces are a little wider and somewhat irregular and growth lines more evident near margin. Immediately posterior to umbos the border is slightly concave, the posterior extremity is narrow and bluntly rounded; the ventral border curves gently to the rounded anterior extremity and the anterior border rises in a straight line to the umbos. The external hinge ligament is yellow brown. The right valve has two cardinal teeth, an anterior and a strong posterior lateral; the left valve has a bifid anterior with a weak posterior cardinal and feeble anterior and posterior laterals. The interior is polished and tinted in shade of the exterior; the posterior adductor scar is impressed, the pallial sinus confluent with the pallial line almost to the anterior muscular impression, the tip distant from it one-half millimeter and the upper border one and a half millimeters below the umbo.

***Tellina mera***<sup>132</sup> Say

Text fig. 4

Alt., 8.75; length, 14 mm. Shell white within and without, rounded-oval, smooth, but not polished; delicate, elevated, concentric striations; umbos sharp, almost central, forming an angle in outline of shell; ligament reddish, not prominent; shell rounded and longer anterior to umbos; posterior end shorter, obtusely angulated with convex ventral margin; two cardinal teeth in each valve and a single prominent lateral tooth in left valve.

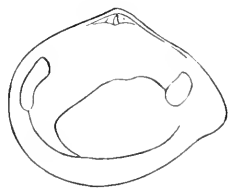


Fig. 4. *Tellina mera* Say

<sup>132</sup> Lat., *mera*, pure.

***Tellina tampaensis* Conrad**

Pl. 42, fig. 302

Alt., 11; length, 15 mm. Shell small, smooth, pale salmon-pink; delicate concentric striations and fine radial markings, thin iridescent epidermis; umbos sharp, making a definite angle in outline of shell; ligament prominent; anterior margin rounded, ventral margin convex, posterior margin sloping to a blunt point; three cardinal and an anterior lateral tooth in each valve; pallial sinus confluent, almost reaching anterior muscular impression.

***Tellina pauperata*<sup>133</sup> d'Orbigny**

Pl. 43, fig. 304

Alt., 6; length, 12 mm. Shell small, white, polished but not iridescent; fine concentric striations and bands of varying opacity; umbos small, acute; anterior border long and straight, posterior short, straight, with slight rostration and rounded extremity; ligament light brown; interior white, polished, with faint radial striation; pallial sinus confluent, tip nine-tenths of a millimeter from anterior muscle scar.

***Tellina promera*<sup>134</sup> Dall**

Text fig. 5

Alt., 10; length, 15 mm. Shell white, smooth, fine threadlike, concentric striae, thin brownish epidermis; general shape like *T. tampaensis*, but more convexly rounded at anterior end and more flexuous posteriorly; pallial sinus large, confluent, extends within one millimeter of anterior muscle scar.

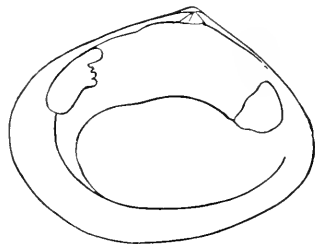


Fig. 5. *Tellina promera* Dall

<sup>133</sup> Lat., *pauperare*, to make poor.

<sup>134</sup> Lat., *pro*, forth; *mera*, pure.

***Tellina similis***<sup>135</sup> Sowerby

Pl. 43, fig. 305

Alt., 18; length, 22 mm. Shell more regularly oval than most of the *Tellinas*. Pale pink or rosy, rayed with a deeper shade; surface sculpture of fine concentric lines of delicate oblique striations; umbos almost central, ligament small; pink within; lateral teeth developed.

Genus **MACOMA** Leach, 1819***Macoma constricta***<sup>136</sup> (Bruguère)

Pl. 16, fig. 100

Alt., 33; length, 50 mm. Shell subequivalve, dull white, sculpture of incremental lines, brownish epidermis heaviest near margins; umbos bluntly pointed; ligament long, narrow; anterior and ventral margins rounded; posterior area flexuose, inclined toward right, with a notch in ventral margin anterior to the flexure; feeble cardinal teeth, laterals not developed; long, confluent pallial sinus.

***Macoma tenta***<sup>137</sup> *souleyetiana* (Réeluz)

Pl. 44, fig. 307

Alt., 10.5; length, 18 mm. Shell inequilateral, small and fragile, white or yellowish, slightly iridescent; fine, concentric lines and delicate radial striations visible both within and without under magnification; umbos small, sharp; ligament small; anterior and ventral margins rounded, posterior margin shorter, straighter and flexuose; hinge margin frail, two cardinal teeth in left and one in right valve, one right posterior lateral tooth; pallial sinus confluent, its end two and three-quarters millimeters from anterior muscle scar.

This is a southern variety of *M. tenta* (Say).

Subgenus **PSAMMACOMA** Dall, 1900***Macoma brevifrons***<sup>138</sup> (Say)

Pl. 16, fig. 100A

Alt., 14; length, 25 mm. Shell oval, inequilateral, white to salmon pink or yellowish; smooth definite growth lines; umbos small, anterior to middle, small ligament; anterior margin short

<sup>135</sup> Lat., *similis*, like.

<sup>136</sup> Lat., *constrictus*, drawn tight.

<sup>137</sup> Lat., *tentis*, stretched out.

<sup>138</sup> Lat., *brevis*, short; *frons*, forehead, front.

and abrupt with submarginal undulation, posterior area flexuose; right valve with two cardinal teeth, one in left; no lateral teeth; interior tinted like exterior; pallial sinus partly confluent, three millimeters from anterior muscle scar.

Genus **STRIGILLA** Turton, 1822

**Strigilla carnaria**<sup>139</sup> (Linné)

Pl. 43, fig. 306

Alt., 12.5; length, 15 mm. Shell smooth, glossy, pale rose color, deepest over umbos; slightly inequilateral, umbos rounded; small lunule; margins smooth and rounded; surface sculpture of extremely fine striae, evenly radiating in central area, oblique over anterior area, meeting central striations in acute angles, oblique and wavy over posterior area; two cardinal and two lateral teeth in right valve, one cardinal and two weak laterals in left valve; interior deep rose-pink; upper border of pallial sinus makes a continuous line between anterior and posterior muscle scars.

Genus **TELLIDORA** (Mörch MS.) H. and A. Adams, 1856

**Tellidora cristata**<sup>140</sup> (Récluz)

Pl. 16, fig. 101

Alt., 22; length, 26 mm. Shell shining white, much flattened, right valve the more convex; thin brownish periostracum; trigonal, with extremely convex ventral margin, anterior border excavated, posterior border almost straight; the anterior and posterior borders of each valve bear a series of sharp serrations; umbos acute, almost central; concentric incremental growth somewhat lamellate and terminating in the marginal serrations; lamellations stronger toward margin; pallial sinus wide, partly confluent.

#### Family **SEMELIDAE**

The mollusks of this family are native to all warm seas, few of its members have become adapted to cold water. One Atlantic species of the genus *Abra* has a range from the Atlantic Ocean to the West Indies, at increasingly greater depths toward the south.

The animals live deeply buried in sandy mud, usually at moderate depths, and are able to desert the old burrows and bury them-

<sup>139</sup> Lat., *strigil*, a scraping tool; *carnis*, flesh.

<sup>140</sup> Lat., *crista*, crest.

selves anew by use of the strong, pointed foot. The two siphons are slender, separate, and about five times the length of the shell.

The shells are compressed, rounded or slightly oval, with a slight posterior flexure, and a short external ligament, very thin epidermis.

Genus **SEMELE** Schumacher, 1817

**Semele bellastrata**<sup>141</sup> (Conrad)

Pl. 16, fig. 102

Alt., 18; length, 23 mm. Shell inequivalve, longest anteriorly; ground color light, with irregular radiate markings of dull purple, visible also within; umbos small, pointed, approximate; sculpture of strong, close, concentric ridges, cancellated by finer, radiating ribs, strongest toward posterior; two cardinal and two lateral teeth in each valve; interior polished, purple or yellow-tinted.

Dredged in four to seven fathoms.

**Semele proficua**<sup>142</sup> (Pulteney)

Pl. 16, fig. 103

Alt., 28; length, 30 mm. Shell orbicular, almost equilateral, color creamy pink with indefinite darker markings; umbos small, a small lunule and a small obliquely excavated escutcheon which contains the ligament; fine concentric lines and delicate radial striations; interior of valves smooth, stippled with pink and purple.

From three to six fathoms.

**Semele purpurascens**<sup>143</sup> (Gmelin)

Pl. 16, fig. 104

Alt., 30; length, 34 mm. Shell subequilateral, greatest length anterior to umbos; margins rounded, umbos small, pointed; ground color cream, with irregular blotched pattern of soft purple, some specimens are deep yellow. The color markings of this shell tend toward a radiate pattern, those of *S. proficua* tend to be transverse. Clear-cut concentric sculpture which fades toward posterior margin; interior of valves deeply colored purple or yellow, fading at margin where external color and pattern show through.

Taken with other Semeles.

**Semele nuculoides**<sup>144</sup> (Conrad)

Pl. 16, fig. 105

Alt., 4.25; length, 6.25 mm. Shell small, white, not thin; in-

<sup>141</sup> *Semele*, mother of Bacchus; *bellus*, beautiful; *striatus*, striped.

<sup>142</sup> Lat., *proficuus*, useful.

<sup>143</sup> Lat., *purpura*, purple.

<sup>144</sup> Lat., *nucula*, nut.

equilateral, longest and a little oblique anteriorly; small, approximate umbos; margins rounded; concentric sculpture of fine, close, equidistant, elevated threads, more delicate over umbonal region, stronger toward margin, with some intercalated riblets which do not extend to posterior margin; interior polished; anterior muscular impression mitten-shaped; posterior round; pallial sinus deep, rounded, the tip five-tenths millimeter from anterior adductor scar; margins smooth.

Dredged at six to seven fathoms.

Genus **ABRA** (Leach MS.) Lamarek

*Abra aequalis*<sup>145</sup> (Say)

Pl. 17, fig. 106

Alt., 10; length, 12.5; diam., 4.5 mm. Shell small, smooth, white, polished, with thin epidermis; orbicular, well rounded, slightly oblique; umbos small, pointed, approximate; numerous minute concentric striations near margins but absent from umbonal area; two small cardinal teeth in right valve, one developed and one vestigial tooth; left valve has remote groove instead of lateral teeth.

Incredible numbers of this mollusk are sometimes washed upon the Gulf beaches after a prolonged northwest blow. Dredged in two to six fathoms.

*Abra lioica*<sup>146</sup> (Dall)

Pl. 44, fig. 308

Alt., 6.5; length, 8; diam., 3.5 mm. Shell small, fragile, opaque-white, polished, extremely thin epidermis; umbos small, definite, nearest posterior margin which deviates slightly to the right; sculpture solely of concentric growth lines which are accompanied by a different degree of transparency in the shell; teeth as in *A. aequalis*.

*Abra lioica* is proportionately longer and more oblique than *A. aequalis* and lacks the groove on the right anterior dorsal margin which is present in *A. aequalis*.

Dredged in three to six fathoms.

Genus **CUMINGIA**<sup>147</sup> Sowerby, 1833

*Cumingia tellinoides* (Conrad)

Pl. 17, fig. 107

Alt., 10; length, 12; diam., 5 mm. Shell thin, white, long-oval,

<sup>145</sup> Span., *abra*, a bay; Lat., *aequalis*, even.

<sup>146</sup> Gr., *leios*, smooth.

<sup>147</sup> Dedicated to the naturalist, Hugh Cuming, who discovered *Conus gloria-maris*.

rounded in front; slightly rostrate behind; posterior margin straight, directed obliquely downward, slightly gaping; umbos pointed, posterior to center; concentric sculpture of numerous threadlike ridges. Each valve has one small cardinal tooth, a central spoon-shaped fossette and elongated anterior and posterior laterals. Interior white, highly polished; pallial sinus deep and rounded.

*Cumingia coarctata*<sup>148</sup> Sowerby

Pl. 17, fig. 108

Alt., 11; length, 16; diam., 8 mm. Shell white, irregular, inflated; thin epidermis; umbos acute, posterior to center, anterior margin high and rounded, posterior margin more abrupt, slightly gaping; small, concentric, definitely lamellar ridges, more widely apart than those of *C. tellinoides*.

Both these species of *Cumingia* are of nesting habit, specimens are often found in cavities of sponges and clumps of debris.

#### Family **DONAXIDAE**

Species of the genus *Donax* of this family are the most abundant bivalves along much of the Florida Coast. Their shells are the principal component of the coquina rock so extensively used in building and road making in the far South.

Their stations are in sandy bottoms of shallow coastal waters, and the mollusks are no less liked in broth and chowder for human delectation than by certain fish and ducks which consume them in great numbers. The family is distributed through all warm seas.

Coquinas live buried just below the surface of sandy sea bottoms with the two delicate siphons projected into the water. In a quiet tide pool the siphons respond to every movement of the water, bending and recovering like a field of grain before the wind.

The foot of *Donax* is strong, sharp, and pointed, and when the animals are dislodged from their shallow burrows they are able to bury themselves before a succeeding wave washes them away.

#### Genus **DONAX** Linné, 1758

*Donax variabilis*<sup>149</sup> Say

Pl. 17, fig. 109

Alt., 11; length, 19 mm. Shell smooth, not glossy; equivalve,

<sup>148</sup> Lat., *coarctare*, to press together.

<sup>149</sup> Gr., *donax*, a dart, a sea scallop; *variabilis*, variable.



inequilateral, somewhat wedge-shaped; umbos low, at summit of posterior slope, directed backward; external ligament behind umbos; elongate anteriorly, short and slightly truncate posteriorly; concentric growth lines and fine radiate striations which become strong and elevated over posterior area; cardinal and lateral teeth present; interior smooth, faintly colored, margins finely crenate.

The range of color of *Donax* is remarkable. White and green, shades of red, brown, lavender, purple, and yellow, variously rayed and plaided make the shells among the most colorful objects upon the beach.

Family **SANGUINOLARIIDAE**

The mollusks of this family were formerly placed among the Tellinas, with which group their range, habits, and shells suggest kinship, but anatomical differences rank them independently. The group has world-wide distribution in shallow and moderate depths.

Like the Tellinas and Semeles the animals have long siphons, a strong foot, and bury themselves in sandy sea bottoms.

Genus **TAGELUS** Gray, 1847

**Tagelus plebeius**<sup>150</sup> (Solander) (*T. gibbus* Spengler) Pl. 17, fig. 110

Alt., 16; length, 43; diam., 7.5 mm. Shell equivalve, subequilateral, subcylindrical, elongate; white, smooth, with glossy, brownish periostracum; umbos postcentral, suppressed; dorsal and ventral margins nearly parallel and in contact only opposite umbonal region; anterior and posterior margins bluntly rounded, gaping; cardinal, but no lateral teeth in each valve; interior white, polished, duplex muscular impressions; deep pallial sinus.

Littoral zone to moderate depths.

**Tagelus divisus**<sup>151</sup> (Spengler) Pl. 17, fig. 111

Alt., 15; length, 38; diam., 6.5 mm. Shell with general characters of *T. plebeius*, slightly more slender, with a slight concavity in middle of ventral margin; shell light-colored, rayed with purple. A strong central ray indicates position of a nearly obsolete internal rib; interior purplish, polished.

Littoral zone to moderate depths.

<sup>150</sup> Lat., *plebeius*, common; *gibbus*, hump.

<sup>151</sup> Lat., *dividere*, to divide.

## Family SOLENIDAE

The family Solenidae is represented in almost all seas in the sandy bottoms of coastal waters. Along the Atlantic seaboard from Newfoundland to Texas, members of this family are known as razor clams. All are edible, but the strong, cylindrical foot enables them to bury themselves so rapidly and so deeply that capture is difficult.

Genus **ENSIS** Schumacher, 1817

**Ensis**<sup>152</sup> *minor* Dall

Pl. 17, fig. 112

Alt., 15; length, 70 mm. Shell equivalve, greatly elongate, gently arched, dorsally concave; umbos at anterior end of dorsal margin, subterminal; anterior margin blunt, posterior slightly narrowed, bluntly rounded. Color bluish white with purple bands parallel to posterior margin and limited to the postdorsal area; a narrow, dark band at anterior margin; polished, yellow-brown epidermis; hinge with cardinal teeth and a lateral plate in left valve; interior milky white; impressions of two adductor muscles; shallow pallial sinus; smooth margins.

In sandy bottoms—on sand bars in shallow water and at moderate depths.

**Ensis minor megistus**<sup>153</sup> Pilsbry and McGinty

Pl. 44, figs. 309a, b

Alt., 17 mm., length, 145.5 mm. This large *Ensis* is similar to *Ensis minor* in form but grows much larger and comes from deep water, while *Ensis minor* is more generally found in bays or quiet water. The valves are thin, with pinkish-brown concentric streaks on the posterior ray.

## Family MACTRIDAE

Members of this family are native to the sandy shores and moderate depths of all seas and in favorable situations become very abundant. They are edible but have a slightly acid, peppery taste.

The shells are equivalve, some of them slightly subequilateral, transversely elongate, more or less inflated in the umbonal region. Two ligaments, one external, and an inner cartilaginous ligament lodged in a spoon-shaped fosse posterior to the bifid cardinal tooth. Two muscular impressions and a pallial sinus.

<sup>152</sup> Lat., *ensis*, sword.

<sup>153</sup> Lat., *megistanum*, magnates, nobles.

Genus **MACTRA** Linné, 1767

Subgenus **MACTROTOMA** Dall, 1894

**Maetra**<sup>154</sup> *fragilis* Gmelin

Pl. 17, fig. 113

Alt., 35; length, 50 mm.; specimens up to 80 millimeters have been recorded. Shell oval, slightly inequilateral; white, with close, narrow concentric ridges and pale-brown epidermis heaviest over posterior rostration; umbos rounded, almost central; anterior and posterior margins sloping to join rounded ventral margin; rostrate and gaping behind; interior white, rounded pallial sinus, smooth margins.

Genus **SPISULA** Gray, 1837

Subgenus **HEMIMACTRA** Swainson, 1840

**Spisula solidissima similis**<sup>155</sup> (Say)

Pl. 17, fig. 114

Alt., 50; length, 70 mm.; specimens have been taken up to 90 millimeters. Shell oval; nearly equilateral; smooth, creamy, with thin, glossy, light-brown periostracum which is thicker at posterior and reflected over the free margin; umbos acute, anterior to mid-line; cardinal teeth and hinge fosse typical, lamellar lateral teeth with opposite deep socket; muscular impressions above center of shell; pallial sinus short; margins faintly crenate.

Genus **MULINIA** Gray, 1837

**Mulinia lateralis corbuloides**<sup>156</sup> Deshayes

Pl. 17, fig. 115

Alt., 11.5; length, 13.5; diam., 6.5 mm. Shell small, trigonal, white, glossy, brownish epidermis; umbos high, inflated; anterior and posterior margins slope abruptly, posterior longer, slightly concave; flat posterior rostration; cardinal and lateral teeth and typical fossette; short, oblique pallial sinus.

Genus **ANATINA** Schumacher, 1817

**Anatina lineata**<sup>157</sup> (Say)

Pl. 18, fig. 116

Alt., 41; length, 50 mm. Shell, white, thin and fragile; thin,

<sup>154</sup> Gr., *maktra*, a kneading trough.

<sup>155</sup> *Spisula*, probably from Von Spix, German naturalist; Lat., *solidus*, solid; *similis*, like.

<sup>156</sup> Lat., *mulus*, a hybrid animal (?); *lateralis*, side; *corbula*, little basket.

<sup>157</sup> Lat., *anatinus*, pertaining to a duck; *linea*, line.

glossy, transparent epidermis; inequilateral, anterior portion broadly rounded, posterior portion demarcated by a cordlike radial rib; margin reflected and gaping; umbos high, directed backward; sculpture of delicate, irregular, elevated concentric ridges; teeth and fossette are typical.

Subgenus **RAETA** Gray, 1853

*Anatina plicatella*<sup>158</sup> (Lamarck) [*A. canaliculata* (Say)] Pl. 18, fig. 117

Alt., 68; length, 70 mm. Shell cordiform, thin, white, inequilateral, obliquely prolonged forward; umbos high, inflated, directed backward; posterior margin sinuous and gaping; sculpture of evenly spaced, rounded concentric ribs, fine striations in intercostal spaces and delicate, irregular radial etching; hinge typical; interior white, smooth; pallial sinus deep, narrow and reflected downward at tip.

Family **CORBULIDAE**

Members of the Corbulidae are widely distributed in most of the temperate seas and through a considerable range in depth.

The shells are small, trigonal, white with brownish epidermis. Subequilateral, posterior portion longer, narrow and rostrate. Extremely inequivalve, the right valve is usually both larger and deeper and more or less overlaps the free margin of the left valve. The umbos are high, inflated, anterior to the middle of the shell and directed backward. The right umbo generally higher than the left. The surface of the valves is concentrically ribbed. Right valve has one prominent, curved, cardinal tooth and a socket for its reception in opposite valve. The interior is chalky white, with two muscular impressions, and a slightly sinuated pallial line.

Genus **CORBULA** Bruguière, 1797

*Corbula contracta*<sup>159</sup> Say Pl. 18, fig. 118

Alt., 5; length, 9; diam., 6.25 mm. Anterior border short and rounded; posterior extremity rostrate, narrow and bluntly pointed; ventral margins contracted with concave sinuosity near center; surface ribbing of elevated threads separated by wider interspaces,

<sup>158</sup> Lat., *plicatella*, little folds; *canaliculatus*, channeled.

<sup>159</sup> Lat., *corbula*, little basket; *contractus*, drawn together.

occasional growth bands near border.

***Corbula caribaea***<sup>160</sup> d'Orbigny

Pl. 18, fig. 119

Alt., 4.5; length, 8.5; diam., 4.5 mm. Adult shells inflated, juvenile often compressed; right valve margin projects beyond and almost encloses left valve, especially toward posterior end; umbos incurved; posterior extremity prolonged and pointed. A slightly flattened area anterior to umbos; posterior rostrum at right angle with plane of valves, oval when viewed from above. A few fine radiating striations, concentric ribs less well marked over posterior slope. Base rather flattened, almost without sculpture.

From four to six fathoms.

***Corbula cubana***<sup>161</sup> d'Orbigny

Pl. 44, fig. 310

Alt., 4.75; length, 8.5; diam., 3 mm. Shell with pink epaulettes radiating from umbos, some specimens entirely pink. Almost equi-valve, right valve a little deeper and its umbo a little higher than left valve, margin slightly overlapping. Posterior rostration pointed at base.

From three to six fathoms.

***Corbula krebsiana*** C. B. Adams

Pl. 18, fig. 120

Alt., 5.1; length, 6.1; diam., 3.5 mm. Shell decidedly trigonal and extremely inequivalve; right valve sharply rostrate; umbos rounded; inflated; closely ribbed.

From four to seven fathoms.

***Corbula swiftiana*** C. B. Adams

Pl. 18, fig. 121

Alt., 5.5; length, 9; diam., 4.5 mm. Shell almost equilateral; right valve deeper and a little longer; overlapping of margin most marked in young shells; posterior rostration sharply marked, the flat area of each valve in same plane; umbos sharp; umbos and anterior and posterior radial ridges opaque milky white; faint radiate striations. Egg capsules of some small gasteropod are often seen on the posterior extremity of these shells, and the shells are often bored near umbos.

From less than one to six fathoms.

<sup>160</sup> Caribbean.

<sup>161</sup> Of Cuba.

Family **HIATELLIDAE**

(Saxicavidae)

Members of this family are distributed in all seas from circum-polar oceans to the Indies.

The mollusks bore into sponge, limestone, and the like, sometimes making deep burrows. Free individuals are anchored by a byssus.

The shells are variable in shape from adaptation to surroundings, inequivalve, usually oblong. The surface is rough, with brownish epidermis.

Genus **HIATELLA** Daudin, 1801**Hiatella**<sup>162</sup> *arctica* (Linné)

Pl. 18, fig. 122

Alt., 13; length, 25; diam., 10 mm. average measurements of undistorted specimens. Shape and proportions so modified by external conditions that adequate description is difficult. Shells chalky white; thin, brown epidermis which scales off readily when dry. Umbos anterior, rounded; posterior portion elongate, rostrate, gaping. Irregular, concentric sculpture, rostrum defined by rough, angular ridges; one cardinal tooth in each valve; two muscular impressions, anterior pointed-oval, posterior irregular; pallial sinus not entire, sinuated.

Family **GASTROCHAENIDAE**

Mollusks of this family are of burrowing habit. They penetrate for a considerable distance into coral, shells, or limestone, or construct a flask-shaped shelter from bits of debris and grains of sand. An excavated burrow and its tunnel of communication with the outside are lined with a smooth, calcareous deposit which generally projects its distal extremity a few millimeters beyond the stone or shell, like a little stovepipe from a roof. Many individuals may burrow into one piece of coral in association with *Lithophaga* and *Rupellaria*.

The shell does not entirely enclose the animal's body, it is thin and fragile, white, equivalve but inequilateral. The umbos are small and anterior. The valves are in contact only along dorsal and posterior borders, yawning widely at the ventral border. The hinge is

<sup>162</sup> Lat., *hiat*, cleft, opening; *ella* diminutive.

edentulous, and there is an external ligament, two unequal muscular impressions and a deep pallial sinus.

Viewed separately the valves are seen to be twisted from plane of the long axis. It is this torsion which produces the extreme anterior gaping.

Genus **GASTROCHAENA** Spengler, 1783

**Gastrochaena ovata**<sup>163</sup> Sowerby

Pl. 19, figs. 123a, b

Alt., 5.75; length, 12 mm. Shell narrows rather sharply toward posterior extremity; concentric sculpture of closely placed, slightly lamellate threads, not equidistant. Interior of valves with definite central, longitudinal ridge.

Burrows often found in shells in *Spondylus* and *Plicatula*.

**Gastrochaena stimpsonii** (Tryon)

Pl. 44, figs. 311a, b

Alt., 6.25; length, 13 mm. Anterior border a little reflected outward causing a notched appearance; surface sculpture only of incremental lines; no interior rib.

Usually found in coral.

#### Family **PHOLADIDAE**

The Pholadidae is a family of penetrating mollusks. Its distribution is through all seas, and some of its members are able to penetrate any substance softer than their own shells. When once established in its burrow, the essential circulation of sea water is maintained through the mollusk's two large siphons.

The shells are white, thin and brittle, with thin epidermis; much elongated, generally narrowed toward the posterior end, equi-valve, gaping at one or both ends. The umbos are inconspicuous, rounded and placed anteriorly. The anterior dorsal margin is more or less reflected over the umbonal region. There is no well-defined ligament, but a posterior accessory plate is present. The sculpture consists principally of prominent ribs and striations. The hinge is edentulous. Each valve has an internal apophysis in the umbonal region. Thin, membranous ligaments unite the valves anteriorly, and posteriorly below the accessory plate.

<sup>163</sup> Gr., *gaster*, stomach; *cheino*, gape or yawn; Lat., *ovatus*, from *ovum*, egg.

Genus **CYRTOPLEURA** Tryon, 1862Subgenus **SCOBINOPHOLAS** Grant and Gale, 1931**Cyrtopleura**<sup>164</sup> *costata* (Linné) [*Barnea costata* Linné] Pl. 19, fig. 124

Alt. to 95; length to 150 mm. Valves inflated, broadly gaping posterior to middle. Radial ribs, most widely separated over anterior area, and crossed by strong growth lines, produce a rough, denticulate sculpture. Margins thin, sharp, denticulate. A spoon-shaped apophysis within umbonal cavity. Interior smooth with reverse pattern of exterior sculpture.

Colonies of these mollusks live beyond low water mark, in individual burrows sometimes several feet deep. Burrows are easily identified by the appearance of two large, united, circular siphons at the sand level.

The common name, angel's wing, is beautifully appropriate to the sculptured, white perfection of this shell.

Genus **BARNEA** (Leach MS.) Risso, 1826Subgenus **ANCHOMASA** (Leach MS.) Gray, 1852**Barnea truncata**<sup>165</sup> (Say) Pl. 19, fig. 125

Alt., 38; length, 60 mm. Shape similar to *C. costata*, but valves truncate behind. Delicate, slightly denticulate sculpture of fine ribs and growth lines; posterior area almost smooth. Umbonal apophysis narrow and curved.

The mollusks live in colonies between tide marks and in shallow water, often in the black mud around the mangrove roots.

Genus **MARTESIA** (Leach) Sowerby, 1824**Martesia cuneiformis**<sup>166</sup> (Say) Pl. 19, fig. 126

Alt., 11; length, 20 mm. Shell broadly wedge-shape, anterior aspect cordiform; divided into anterior and posterior areas by an

<sup>164</sup> Gr., *cyrtos*, curved; *pleuron*, side; Lat., *scobina*, file; Gr., *pholas*, hole-dweller; Lat., *costa*, rib.

<sup>165</sup> Gr., *ankyra*, anchor; *masa*, to chew, to thrust out the lip; Lat., *truncatus*, cut off.

<sup>166</sup> Lat., *cuneus*, wedge; *forma*, form.



oblique sulcus. Anterior area ribbed by toothed ridges; posterior area shows only growth lines. The posterior shield (protoplax) is lanceolate with a median, longitudinal furrow and oblique radiating sulci.

The mollusks usually bore into wood, sometimes into soft rock.

*Martesia striata*<sup>167</sup> (Linné)

Pl. 19, figs. 127a, b

Alt., 10; length, 35 mm., in favorable circumstances 50 mm. Shell narrowly cuneate, prolonged posteriorly; anterior aspect cordiform, with sinuous, crenulate ridges and delicate radial sculpture; posterior area shows only wavy growth lines. A narrow, shallow sulcus separates the two areas. The protoplax is normally trilobed; in young and stunted specimens the lateral lobes may be suppressed and the shield somewhat trigonal.

This *Martesia* penetrates hard wood.

The juvenile of this species is so different in appearance that it has been described as a new species by several authors, but a study of the life cycle proves it to be the same shell. The anterior margins are widely gaping and the shell being much shorter than the adult, assumes a slightly heart-shaped appearance. An illustration of the juvenile appears on Plate 45, figure 127c.

#### Family TEREDIDAE

*Teredo* is a name given by Pliny to a wood-eating worm. Even before Pliny's time, the shipworm was recognized as an agent of destruction to wooden ships, and today, the ravages of this mollusk in wooden structures is a costly matter; no wood is known to be wholly resistant to attack. Shipworms have been cultivated in soft wood, and collected for food when the desirable size attained. Their distribution is world-wide.

The mollusks of this family have evolved an aberrant form; they are elongate, wormlike, with only the anterior extremity covered by the small, bivalve shell.

The life history of no one species is fully known; some discharge the ova into the sea, some are viviparous. The larvae all have bivalve shells, and swim freely for a short time but soon attach

<sup>167</sup> Lat., *striatus*, channeled.

themselves to some wooden structure and begin excavation of the long tunnel which is to be the permanent home. There is evidence that the wood boring is effected by use of the shell as a file, and also that the accumulation of sawdust is ingested by the shipworm and has some food value. The burrows are long and follow the grain of the wood except at the point of entrance and where another burrow or a knot is encountered.

The anterior, shell-bearing portion of the mollusk's long body lies at the bottom of the burrow; the siphon end is at the opening, and when complete, the burrow is smoothly lined with an adventitious, calcareous tube.

The shell is white, globose and gaping, its external surface bears many diversely sculptured teeth. The posterior end of the mollusk bears a pair of calcareous structures called pallets, which may be advanced or withdrawn to close or open the mouth of the tube. Characters of the shell and distinctive features of the pallets are necessary factors in differentiating species. Reference to a collection is necessary for specific determination.

Genus **TEREDO** Linné, 1758

***Teredo***<sup>168</sup> ***floridana*** Bartsch

Pl. 45, figs. 313, 314

Shell small, nearly round, white. The two halves gape widely, the foot extending through the anterior side, and the long wormlike body through the posterior side. There are three parts to the shell: the lobe, the disc and the auricle. The umbo is smooth; the remaining portion of the lobe is denticulated. The anterior portion of the disc is broad and more coarsely denticulated than the lobe. The middle and posterior portions of the disc are smooth. The auricle is small, smooth, being marked only with growth lines, and is joined to the margin of the posterior disc. It is covered by the mantle in living specimens. On the interior are the condyles, calcified prominences, one dorsal and one ventral. These condyles meet in the two valves, forming a double hinge, upon which the two valves move back and

<sup>168</sup> Lat., *teredo*, *teredinis*, a worm.

forth, in a revolving manner, in boring. Each valve has an apophysis; a long, riblike process, to which the muscles of the foot are attached. The two pallets, which are placed in the posterior end of the animal, are flat, with a stout, rounded stalk, ending in a slight calcified knob.

#### Class SCAPHOPODA

This is the smallest class of the Mollusca. The anatomical structure of its members differs so widely from that of other members of the phylum that it was not until 1819 that scaphopods were established as mollusks and separated from those marine worms which secrete calcareous tubes. Scaphopods show definite relationship to gasteropods in the possession of a univalve shell and a radula, and to the pelecypods in similarity of the foot and lack of a distinct head. The animals are eyeless, nonoperculate, carnivorous, and unisexual. They are found in all but polar seas, and their bathymetric range is from less than one fathom to abyssal depths.

The name Scaphopoda, derived from the Greek *scapha*, boat; *pod*, foot, is descriptive of the pointed burrowing extremity belonging to mollusks of this class. The shape of the foot suggests a vessel's sharp prow or ploughshare, and differences in the development of its tip present important family characters. Small carnivorous mollusks are their worst enemies, and shells are frequently found which have been bored near the apex.

The shells are tubular, nonspiral, open at both ends, and generally tapered toward the posterior end. All growth takes place at the anterior—larger—end, and the posterior extremity is truncated as growth proceeds at the opposite end. The size of the shells varies from two or three to one hundred seventy-five millimeters. This type of shell is characteristic of the group and is found nowhere else among the Mollusca.

Scaphopod shells have been used as ornaments and as charms against the evil eye, and among the Indian tribes of Northwest America, strings of the perfect shells of a Pacific species of *Dentalium* represented the gold standard until superseded by the more practical advantage of the Hudson's Bay Company's blankets.

## Family DENTALIIDAE

The mollusks of this family live partly buried in the sand or ooze of the sea bottom. They assume a position oblique to the surface with the siphon end of the shell projecting in order to provide for free circulation of the currents of sea water necessary to the creature's existence. From the larger, buried end of the shells, the animal extrudes the foot and numerous long, delicate filaments, club-shaped at their tips. These filaments feel about in the sand and capture small prey, usually Foraminifera, but sometimes small bivalves, which are carried to the mouth parts.

This family has but one genus, *Dentalium*; all its species have elongate, tapering, tubular shells, more or less curved in the long axis; they are open at both ends and diminish regularly in diameter from the large anterior opening to the small posterior orifice. The anterior opening is simple, sharp-edged, never contracted nor reflected. The posterior end of the shell is truncated, and its opening may be simple, notched, or slit and sometimes furnished with a small supplementary tube extended from the orifice in the direction of the long axis of the shell. The dorsal aspect of the shell is concave.

Most of the *Dentalia* are white, a few are tinted with pale salmon-pink or a green tone near the apex, but any coloration soon fades after the death of the animal. The quality of the shell varies from a dull, chalky surface to a high polish. Apical characters, sculpture, and the degree of curvature of the shell are important features in the determination of species.

## Genus DENTALIUM Linné, 1758

*Dentalium*<sup>169</sup> *laqueatum* Verrill

Pl. 20, fig. 128

Alt., to 45; diam., 3.5 to 6 mm. Anterior part of shell only slightly arched, tip sharply curved; aperture circular and fluted; opaque-white; apex is angled by 9 to 12 strong ribs with equal-sized, concave intercostal spaces. The ribs become broader and inter-spaces less concave toward the anterior extremity; fine longitudinal lines on the ribs of unworn shells and almost microscopic reticulation

<sup>169</sup> Lat., *dens*, *dentis*, tooth; *laqueo*, to adorn with panelled surface.

over the entire surface. Apical notch or slit on convex side, often obliterated. A supplementary tube is present only in young shells.

Dredged in four to seven fathoms.

**Dentalium texasianum** Philippi

Pl. 20, fig. 129

Alt. to 30; average 25; diam., 2 mm. Shell more strongly curved posteriorly than in anterior portion. Hexagonal in section except when development of extra ribs result in a somewhat circular and fluted aperture. Dull, dirty white; strong and solid. Six or seven ribs at apex with broad, flat intercostal spaces showing growth lines and intercalated ribs. No apical notch or slit, but usually a supplementary tube.

Dredged in two to seven fathoms.

Subgenus **ANTALIS** Hermannsen, 1846

**Dentalium pilsbryi**<sup>171</sup> Rehder (*D. pseudohexagonum* Henderson)

Pl. 20, fig. 130

Alt., 28; diam., 2 mm. Gently and evenly curved; section circular, fluted externally; tip not notably slender; white, not polished; nine elevated, rounded ribs with number increased by secondaries, but none are prolonged to the anterior end of shell. Wide, flat intercostal spaces crossed by strong growth lines; no apical notch.

Dredged in less than one to five fathoms.

**Dentalium disparile**<sup>172</sup> d'Orbigny

Pl. 20, fig. 131

Alt., 14 to 28; diam., 2 mm. Regularly and moderately curved throughout its length. Section circular, showing marginal riblets; dull white. Tip slender, hexagonal—the angles extended into six or more narrow primary ribs which separate concave intercostal spaces. There are two broad interspaces with a median rib on the concave aspect of shell, and three narrow spaces on the side convexly curved. Some secondary ribbing is present, and there are inconspicuous growth lines. No notch, but often a supplementary tube.

From one to five fathoms.

<sup>171</sup> Named for Dr. Henry A. Pilsbry; Gr., *pseudos*, false.

<sup>172</sup> Lat., *dispar*, unequal.

Subgenus **GRAPTACME** Pilsbry and Sharp, 1897

**Dentalium eboreum**<sup>173</sup> Conrad

Pl. 20, figs. 132a, b

Alt., 25 to 38; diam., 2 to 2.75 mm. Slender; evenly and moderately curved; much reduced in diameter posteriorly; circular in section; white, salmon-pink in fresh shells; surface shining and polished, occasionally with opaque patches. Apical third of shell is sculptured with about 20 exceedingly fine and delicate riblets which fade into the smooth surface. Growth lines obscure. There is a narrow and deep apical slit on the convex side, frequently lost by wear and breakage; a supplementary tube is often present which shows the typical deep, narrow slit.

From one to six fathoms.

Subgenus **LAEVIDENTALIUM**<sup>174</sup> Cossmann, 1888

**Dentalium callipeplum**<sup>175</sup> Dall

Extreme alt., 62; diam., 5 mm. The shell is characterized by strong and even curvature and rapid increase in diameter. Strong, thin, polished, cream color, entirely lacking in sculpture; shallow apical notch or indication of one on the concave side; section is circular.

Occasional fresh beach specimen.

Family **SIPHONODONTALIIDAE**<sup>176</sup>

Members of the three West Atlantic genera of this family are mollusks of deep water. Their shells are not likely to be taken in the course of general collecting. Prominent features resemble those of the Dentaliidae. They live in soft mud or sand and the foot or expanded disc, is capable of contracting to a slender stalk. Burrowing is done by thrusting the conic foot downward, expanding it into a disc, which forms an anchor. The shell is pulled down by contraction of the foot muscle, and this process is repeated over and over. *Solen* and *Barnea* use this same method of locomotion.

<sup>173</sup> Lat., *ebur*, ivory.

<sup>174</sup> Lat., *laevis*, smooth.

<sup>175</sup> Gr., *kalos*, beautiful; Lat., *peplus*, skirt or shawl.

<sup>176</sup> Gr., *siphon*, a tube; *dens*, *dentis*, a tooth, tooth-shaped.

Genus **CADULUS** Philippi, 1844**Cadulus quadridentatus**<sup>177</sup> Dall

Pl. 15, figs. 315a, b

Alt., 8 mm., greatest diam., about 1 mm. This tubular shell is creamy white, smooth and glossy; slightly swollen above the middle, contracting slightly toward the apex which is entire and unslit; moderately curved, contracting rapidly to the posterior opening, which has four triangular notches, forming the four pointed teeth.

**Cadulus carolinensis** Bush

Pl. 45, fig. 316

Alt., 10 mm., anterior opening, 1 mm., greatest diam., 1.5 mm., posterior opening, .5 mm. Curved shell is bluish white, almost transparent and shiny. Anterior opening round, oblique. Shell swells somewhat toward the middle, contracting gradually to a small, round posterior aperture which has four shallow notches, forming four short, rounded teeth.

Class **GASTEROPODA**

The Gasteropoda (Lat., *gaster*, stomach; Gr., *pod-*, foot), are numerically the largest division of the Mollusca, and their shells are the most varied in form. The animals are highly organized—all have distinct heads and usually cephalic tentacles and structurally complex eyes. The senses of touch and smell are highly developed. Some gasteropods are unisexual, some are hermaphrodites and a few are viviparous. Most of them deposit their spawn in capsules whose shape is characteristic of their species. In other cases, the ova are extruded in a cordlike or ribbonlike matrix of gelatinous material.

A curious structure possessed in common by the Gasteropoda, the Amphineura and the Scaphopoda, is the radula or lingual ribbon. This is a chitinous band within the mouth or pharynx having upon its outer surface many, and usually small, teeth. The radula is moved back and forth by special muscles or used with a gimletlike action. It serves to pierce the shells of captured mollusks, to tear and shred the food of the carnivorous, and as a rasp in case of the vegetable feeders. This structure has no analogue in any other group of animals.

<sup>177</sup> Lat., *cadus*, small pail, jar; *quatuor*, four.

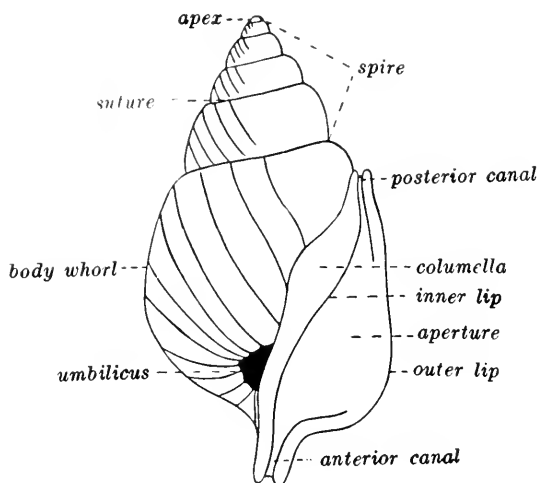


Fig. 6. Diagram showing the characteristic features of a gastropod.

The gastropod shell consists of one unit and is called univalve in distinction from the pelecypod shell which has two units and is called bivalve. The univalve shell may be regarded as a cone spirally twisted about its central axis or columella. Almost any possible modification of this cone may develop from the flat and expanded *Sinum* to the slender elongated *Terebra* or the tentlike *Fissurella*.

Modifications of the primary cone produce shells which vary widely in the relative proportions of different parts, but all have certain features in common which it is needful to know in order to proceed with classification. The living mollusk bears the shell with the apex posterior and the aperture downward, but for the purpose of examination the univalve shell should be held with the apex upward and the aperture facing the observer. The apex is the extreme top of the shell and in many cases is the nucleus or embryonic shell with which the young mollusk emerged from the egg. Below the apex are several turns or whorls, separated by more or less deeply impressed sulci called sutures. These sutures may be shallow or deeply cut, and the whorls themselves may be convex or more or less



flattened. The last and largest whorl is called the body whorl, in which is the aperture or mouth of the shell through which the animal extrudes the foot and the parts concerned with feeding. All the whorls together, exclusive of the body whorl, form the spire. To count the whorls place the shell with the aperture downward and count every whorl up to but not including the apical whorl.

The whorls show great variety in shape and sculpture. Some are flat and smooth, hardly showing microscopic markings, and from this simplicity the range broadens to include forms of the greatest complexity. The purpose of this sculptural decoration is considered to be protective, though nothing is certainly known of the reasons for such wealth of form, pattern, and color as is exhibited by gasteropod shells.

The aperture may be of any shape between round or oval and the long, narrow slit with parallel margins as seen in *Conus* and *Oliva*. The outer lip may be thin or thickened, plain, dentate, or alate. There may be a notch at either or both the top and the lowest part of the aperture, and one or both of these notches may be prolonged into canals. Sometimes the upper (posterior) notch is absent, and often the lower (anterior) notch is produced into a canal of variable length which may be open along one side or closed throughout its entire extent. The columellar or inner lip may be perfectly simple and smooth or folded into plications which are often characteristic of the group to which the shell belongs. An entire, simple aperture denotes a vegetable feeder, but the rule is not invariable. Most probosciferous mollusks whose shells have canaliculated apertures are carnivorous and prey upon their own relatives, especially bivalves, whose shells they attack at the most vulnerable point and nearest to the essential organs.

The columella is the central pillar or column which passes through the shell from base to apex. It is the axis about which the whorls revolve and near its apex is affixed the columellar muscle which is the sole attachment of the mollusk to its shell. Contraction of this muscle retracts the animal into its shell and brings the operculum into position to close the aperture.

Most gasteropods have opercula. The operculum is a special

cuticular development upon the foot and is placed precisely over the end of the strong muscle which attaches the mollusk to the columella of its shell. The operculum more or less completely closes the shell's aperture when the mollusk is retracted within, and it may be held in this position for a long time if the animal is alarmed or exposed to drying. Generally the operculum is adapted to the shape of the aperture. In structure, it may be corneous and of a brown or yellowish color, or calcareous, when it is usually white or tinted with pinkish, brownish, or green coloration. Opercula vary much in shape and thickness, they are rudimentary in some genera and in others entirely lacking. There is a nucleus from which growth proceeds concentrically or excentrically; the position of the nucleus differs in different genera and is of importance in classification.

The usual turn of the gasteropod shell is to the right—dextral—showing the aperture on the right side when the shell is held with the apex upward. Some species are normally sinistral—the spiral turns leftward from the apex, placing the aperture on the left side when the shell is held apex upward. Species which are normally dextral may develop sinistral abnormalities, and species which are normally sinistral sometimes present a right spiral.

Anomalies of the gasteropod shell are not uncommon. They appear more frequently than among the shells of the Pelecypoda or the Amphineura. *Busycon* "*contrarium*" often shows deformities and duplications of the canal for its entire length, but rarely any deformity of the body of the shell. Embryonic shells, still in the egg capsule, have been observed by Perry which show the same deformities as those seen in semiadult and adult specimens; this does not seem to have been previously noted. Many individuals show deformities of the whorls which are due to the inclusion of barnacles or boring mollusks.

Albinism is observed in *Busycon*, *Murex*, *Strombus*, *Oliva*, *Urosalpinx*, and *Muricopsis*, and the operculum of such a shell is of a much paler color than the normal form.

Many gasteropods leave trails in sandy sea bottoms which are as distinctive to the experienced collector as trails in the snow are to the hunter. *Natica*, *Polinices*, *Melongena*, *Busycon*, *Fasciolaria*,

*Terebra*, *Oliva*, *Olivella*, *Nassarius*, and *Cerithium* leave characteristic footprints and generally may be turned out from the sand at the trail's end.

Along the southwest Florida coast and on the outlying islands are many midden sites of the aboriginal key-dwellers, and in these mounds are found numerous implements made from the shells of *Fasciolaria* and *Busycon*. These shell tools have holes for handles, and some of them show marks of the thongs which bound these handles in position. Smaller shell tools may have been used to break the shells of living conchs which were used for food. The middens are mainly of oyster shells.

Order **ARCHAEOGASTEROPODA**<sup>178</sup>

Family **ACMAEIDAE**

Atlantic species of the genus *Acmaea* occur from far north to Florida and the West Indies. In general, they are mollusks of the littoral region, living among sea grasses and weeds or upon rocks; few deep water species are known. The animal has eyes placed at the upper part of the base of its long, cylindrical tentacles and has a proboscis bordered with fringelike processes.

The shells are conical, oval, and open at base, more or less depressed; apex not perforate, inclined forward, nearest to the anterior border of the shell. The interior is concave—saucerlike.

Genus **ACMAEA** Eschscholtz, 1830

*Acmaea antillarum*<sup>179</sup> (Sowerby)

Alt., 6; length, 20; width, 11 mm. Summit well elevated, not acute; surface with numerous diverging rays of blue-gray on a lighter background. Interior blue-white with alternating dark and light markings about the margin and with a horseshoe muscular impression open toward the front.

Family **FISSURELLIDAE**

This is a widely distributed family of mollusks, all of which

<sup>178</sup> Gr., *archaios*, ancient; ancient gasteropods.

<sup>179</sup> Gr., *acme*, point, prime; of the Antilles.

share the characters of short snout, cylindrical, pointed tentacles with eyes near their outer basal portions, and a large oval foot. The animals are vegetable feeders and move about freely.

The shells are conical, oval at base, patelliform, either perforate at the apex or having a notch or slit in the anterior margin. The external surface is ribbed or cancellated, and the margins may be crenulated or smooth. The interior of the shell is smooth, and the apical perforation is usually defined by a circumscribed, elevated callus.

Their distribution is through all except Arctic seas, and the range in depth is great.

Genus **LUCAPINA** Sowerby, 1835

**Lucapina suffusa**<sup>180</sup> (Reeve)

Pl. 21, fig. 133

Alt., 3.5; length, 15; width at middle, 10.5. Shell conical, oblong-oval, depressed, slightly narrower in front; color white or grayish with seven to nine broad rays of darker color; summit anterior to middle, perforation oval, almost the shape of aperture; side-slopes moderately convex; alternately larger and smaller radiating ribs cancellated by strong concentric ridges; interior bluish white, strong callus about perforation which is truncate behind with a tint of green laterally; margins crenulate.

Genus **LUCAPINELLA** Pilsbry, 1890

**Lucapinella limatula**<sup>181</sup> (Reeve)

Pl. 21, fig. 135

Alt., 3.5; length, 15; width at middle, 9 mm. Shell small, flattened oblong, wider posteriorly; summit almost central, shape of orifice corresponds to marginal outline; color an irregular blending of light and dark gray, often with more or less dull rose; radiating ribs alternately large and small in front; laterally and behind, three small riblets alternate with larger ribs which separate wider interspaces than those of anterior portion of shell; regular concentric, laminate ridges form semierect, curved scales at rib intersections; interior white, somewhat translucent to external coloration; callus

<sup>180</sup> Lat., *lucanus*, a beetle; *suffusa*, to colour.

<sup>181</sup> Lat., dim, of *lima*, file.

about perforation narrow, entire; anterior and posterior margins crenulate.

Genus **DIODORA** Gray, 1821

**Diodora**<sup>182</sup> **meta**<sup>183</sup> (von Ihering)

Pl. 21, fig. 134

Alt., 4; length, 16; width at middle, 11.5 mm. Shell conical-depressed, oblong-ovate, summit anterior to middle, aperture oval; color white or grayish, rayed with darker shade, sometimes mossy green; radiating riblets alternating in size, cancellated by strong, regular, concentric ridges, nodular at intersections with ribs; interior white, callus about perforation, dark-colored and slightly truncate behind.

**Diodora cayenensis** (Lamarek)

Pl. 21, fig. 136

Alt., 12; length, 22; width at middle, 19 mm. Shell rather thick, oblong-oval, conical; color white or buff with markings of light and dark gray; summit anterior to middle; anterior slope straight or slightly concave, posterior slope convex; orifice keyhole shaped, excavated; sculpture of three small ribs between two large radiating ribs, crossed by concentric, lamellar ridges which become semi-erect curved scales at intersections of ribs; interior white, polished, translucent to exterior coloration; heavy callus about aperture which is truncate behind with a depression immediately posterior; margins finely and regularly crenulate; only anterior and posterior margins in contact with flat surface.

**Diodora listeri**<sup>184</sup> (d'Orbigny)

Pl. 21, fig. 127

Alt., 12; length, 38; width at middle, 25 mm. Shell corresponds to *D. cayenensis* in general characters but is larger and heavier. Sculpture of alternately larger and smaller ribs deeply cancellated by strong, cordlike concentric ridges. Interior white; margins crenulate with the denticulations arranged in pairs.

Genus **RIMULA** Defrance, 1827

**Rimula**<sup>185</sup> **longa** Pilsbry

Pl. 45, fig. 317

Length, 6.5 mm., breadth, 3 mm., height, 1.8 mm., length of

<sup>182</sup> Gr., *dia.*, through; *dora*, hide, fur.

<sup>183</sup> Lat., *meta*, cone, pyramid.

<sup>184</sup> Dedicated to Lord Martin Lister.

<sup>185</sup> Lat., *rima*, a cleft, fissure.

slit, 1.5 mm. Shell chalky white, oblong, width less than half the length; apex small, near the posterior end; anal hole about halfway up anterior convex slope; anal fasciole shallow, extending from the perforation to the apex; sculpture of radial ribs and concentric threads; interior glossy, margin slightly crenulated.

Family **TROCHIDAE**

The iridescent nacre which enters so largely into the composition of trochid shells gives them status among the "elegant families". In many species, a dark periostracum conceals the intrinsic beauty of their lustre from without, but the pearly lining of the interior is always evident.

The animals are more or less brightly colored in shades of red or terracotta. The head bears two tentacles and between them are two curiously flattened palmettes; a thick fold along each side of the foot gives attachment to a number of tendril-like processes which are always in motion when the creature is active and create an impression of delicacy and daintiness. These herbivorous mollusks are often found among seaweeds.

The shells are variable in shape, some are regularly conic or pyramidal, some turbate, and some heliciform. The shape of the aperture is also variable. The operculum is corneous, round, multi-spiral, with a central nucleus.

The many genera of this group are widely distributed through all warm seas, most abundantly in the littoral region though some have been dredged from considerable depths.

Genus **CALLIOSTOMA** Swainson, 1840

*Calliostoma englyptum*<sup>186</sup> (A. Adams)

Pl. 21, fig. 138

Alt., 21; width of base, 20 mm. Shell conical, imperforate; rosy brown with darker and lighter flammules and patches usually based on sutural lines; apex dark red, a dark marking outlines apical whorls; spire rather evenly conic; four or five whorls; shoulders of lower whorls rounded; sutures slightly incised; base nearly flat; sculpture of finely beaded spiral lirations, alternately larger and smaller; the penultimate whorl bears from seven to ten and the base from ten

<sup>186</sup> Gr., *kalos*, beauty; *stoma*, mouth; *eu*, well; *glyphein*, to carve.

to twelve of these lirae, those upon the base separated by finely striated interspaces; aperture simple, quadrate, nacreous within; columella oblique, thickened at base; operculum corneous, thin, circular, multispiral, with central nucleus.

Dredged from four to six fathoms.

**Calliostoma pulchrum**<sup>187</sup> (C. B. Adams) (*C. velici* Pilsbry) Pl. 21, fig. 139

Alt., 11; width of base, 9 mm. Shell conical, imperforate, whorls not rounded, angulate; shoulder below middle of whorl; ground color yellowish, with more or less regularly spaced longitudinal flammules of pinkish purple; base unicolored; apex sharp; about five whorls with spiral sculpture of beaded lirae, the most prominent lirations at shoulder of whorls; numerous lirae, alternately larger and smaller over base; sutures clearly defined; aperture simple, quadrate, nacreous within; outer lip bluntly angled in accord with shape of whorls; columella short, oblique, thickened at base; base of shell not quite flat, umbilicus wanting; operculum typical.

Dredged from three to six fathoms.

**Calliostoma jujubinum perspectivum**<sup>188</sup> (Koch) (Philippi)

Pl. 21, figs. 140a, b

Alt., 15.5; width of base, 15 mm. Shell more smoothly conical and whorls less defined than in *C. euglyptum* and *C. pulchrum*; color brown or reddish brown with quite regularly distributed buff-colored flammules; apex sharp, dark-colored; four to six whorls, sculptured with closely placed spiral lirae, strongest at shoulders of whorls and alternately larger and smaller over body whorl; sutures not well defined; aperture simple, quadrate, angled at outer base, nacreous within; columella concavely curved; base deeply perforate, a coarsely beaded spiral lira outlines the umbilicus; operculum typical.

Not uncommon on beaches, dredged in three to six fathoms.

Eggs in long gelatinous ribbon, several inches long, 3 to 4 mm. broad, attached at intervals to glass of aquarium and part of it floating. Inside of ribbon are numerous yellowish eggs, irregularly arranged, 25 to 28 mm. covered by thin membrane and floating in a nutrient layer in the egg covering, the latter surrounded by a thick layer of jelly, originally spherical, becomes more or less polyhedral by pressure of its neighbors. —Marie Lebour.

<sup>187</sup> Lat., *pulchrum*, glorious, fine.

<sup>188</sup> Lat., *perspectivus*, to look through.

Family VITRINELLIDAE<sup>189</sup>

The shells of this family are white or corneous, sometimes transparent, with no trace of a nacreous layer; their form is turbinate, depressed, deeply umbilicate, with an almost circular aperture and simple, sharp lip. The operculum is corneous, similar to the trochid operculum.

Genus **PARVITURBOIDES** Pilsbry and McGinty, 1950

**Parviturboides**<sup>190</sup> **interruptum** **sanibelense** Pilsbry Pl. 22, figs. 141a, b

Alt., 1.1 mm., diam., .9 mm. Shell is low-turbinate, base flattened and somewhat funnel-like around the narrow umbilicus; color slightly off white, moderately translucent; thin, papery periostracum; about three and a half rounded whorls; upper whorls almost smooth; spiral threads with wider interspaces, begin on penultimate whorl, increasing in number to seven on body whorl; the interspaces are crossed by occasional faint growth lines. The aperture is simple, oblique and a little flattened above; outer lip thin; columella a little thickened with a short parietal callus below. The operculum is corneous, multispiral, much resembling the operculum of *Calliostoma*.

Genus **CYCLOSTREMISCUS** Pilsbry and Olsson, 1945

**Cyclostremiscus**<sup>191</sup> (?) **trilix**<sup>192</sup> (Bush) Pl. 22, figs. 142a, b  
Pl. 49, figs. 336a, b, c

Alt., 1 mm., diam., 2.3 mm. Shell white with thin periostracum; turbinate, much depressed, apex slightly elevated; two or three whorls, evenly convex at shoulder, flattened above and below, sutures not channeled; aperture rounded, simple, oblique in outline and oblique in relation to vertical axis of shell; outer lip thin; whorls are almost destitute of sculpture, a few lightly incised spirals and often a slight puckering below sutures; base shows one well-incised spiral near outer margin and one or two others less defined; umbilicus deep and funnel-shaped, showing turn of whorls to apex.

Dredged in four fathoms, Gulf of Mexico off Sanibel Island. Occasional beach specimens.

<sup>189</sup> Lat., *vitrum*, glass; shells of glassy texture.

<sup>190</sup> Lat., *parvus*, little; *turbo*, top, circle; Gr., *eidos*, form, shape.

<sup>191</sup> Gr., *kykos*, circle; *trema*, aperture.

<sup>192</sup> Lat., *tri*, three; *lix*, flowing (lines).



Genus **COCHLIOLEPIS** Stimpson, 1858

<sup>4</sup> **Cochliolepas**<sup>193</sup> **striata** (Stimpson) Dall Pl. 22, fig. 142C

Alt., 1.3 mm.; greatest diam. of base, 7.25 mm. Shell auriform, greatly flattened, widely umbilicate, thin and horn-colored; nuclear whorl and apex not elevated; two rounded whorls increasing in size to aperture which is expanded and oblique with posterior portion of sharp outer lip somewhat prolonged over shoulder of body whorl; interior of aperture smooth and shining; external surface engraved with fine parallel striations.

This mollusk is parasitic upon certain annelids.

Family **TURBINIDAE**

Genera of the family Turbinidae are native to tropical and subtropical seas. The animals somewhat resemble the trochids in the possession of palmettes and the lateral cirri. They are herbivorous, and confined by this habit to depth zones in which marine vegetation can flourish. Their principal food is said to be marine algae.

The shells are rather heavy and solid, turbinate or trochiform in shape, not umbilicate; external surface is rugose or smooth with thin epidermis; the aperture rounded, oval or subtetragonal with a simple lip. Operculum is calcareous, flat on inner surface, externally convex.

Genus **TURBO** Linné, 1758

**Turbo castaneus**<sup>194</sup> Gmelin Pl. 22, fig. 143

Alt., 30; diam., 25 mm. Shell oblique-ovate, solid, with thin periostracum; color varies through gray, orange and chestnut brown, usually maculated with darker or lighter markings on light or dark background. Spire conic, about one-third of altitude; five or six rounded whorls; sutures channeled; sculpture of strongly beaded spiral lirae of varying size, with fine incremental lines in interspaces; aperture nearly circular, nacreous within; outer lip sharply crenulate; columella white, with white callus; peristome continued below; not umbilicate; operculum calcareous, inner surface flat, chestnut color; convex externally and often stained with a green or brown tint.

<sup>193</sup> Gr., *cochlias*, snail, snail shell; *lepas*, scale.

<sup>194</sup> Lat., *turbo*, a top; *castanea*, chestnut.

Rarely, specimens of a dark-green color are found. This coloration seems not to be due to any extrinsic cause.

Not uncommon on grassy bottoms of littoral zone.

#### Family **NERITIDAE**

Special interest attaches to the Neritidae on account of their adaptation to diverse conditions of environment. Some of its genera are exclusively marine and prefer rocky stations, some are restricted to brackish water, others are fluviatile, while some are able to maintain themselves for long periods without wetting. The animals are herbivorous and have the unusual habit of placing their eggs upon their own shells and those of other mollusks.

The shells are globular or subglobular with the body whorl more or less expanded, the spire short and inconspicuous, semilunar aperture and simple outer lip. The operculum is calcareous and is furnished with an apophysis which articulates with the opposite portion of the columella.

Genus **SMARAGDIA** Issel, 1869

**Smaragdia viridis**<sup>195</sup> *weyssei* Russell

Pl. 22, figs. 144a, b

Alt., 8; diam., 5 mm. Shell small, smooth, translucent, obliquely-oval, subglobular, imperforate; color grass-green or yellowish green, unevenly maculated with white in an interrupted longitudinal arrangement; a narrow, sharp pencilling of dark-maroon color usually outlines the white spots on the side toward the apex or toward the columella; occasionally some black appears in the color pattern and some few specimens are unicolored. A thin, glossy epidermis gives an appearance of elegance to this small shell. The apex is minute, scarcely elevated, about two whorls, body whorl much enlarged and expanded. Aperture simple, semilunar, outer lip thin, sharp; columella oblique, finely denticulate; translucent callus. Operculum greenish, overlaid with a polished, translucent callus. Operculum calcareous, green, nucleus excentric near lower-inner margin, a strong bifid apophysis at lower columellar angle and a longitudinal fossa in the columella margin.

The animal is green, with eyes placed at outer bases of pointed,

<sup>195</sup> Gr., *smaragdus*, emerald; Lat., *viridis*, green.

cylindrical tentacles.

This is a marine member of the family, usually found among sea grasses at moderate depths.

Order **MESOGASTEROPODA**<sup>196</sup>

Family **EPITONIIDAE**

All seas afford habitats to members of this widely distributed family, but the greatest number and diversity of species are found in West Indian waters. They are predatory, carnivorous animals, usually frequenting sandy stations where abundance of animal food is available. The cephalic end of the mollusk bears two long, pointed, mobile tentacles, an invaginable trunk and two black eyes placed on the summits of small tubercles at the outer bases of the tentacles.

The shells are turriculate, usually white and polished, with many convex ribbed whorls which gradually and regularly increase in size from apex to base. The aperture is nearly circular with a thickened, reflected lip which will eventually become a new varix. Base is perforate, but umbilicus is usually concealed by an expansion of the inner margin. The thin, corneous operculum entirely closes the aperture.

Genus **EPITONIUM** Röding, 1798

Subgenus **NITIDOSCALA**<sup>197</sup> de Boury, 1909

**Epitonium angulatum**<sup>198</sup> (Say)

Pl. 46, fig. 319

Alt., 19 mm. Shell white, polished, apex sharp, nuclear whorls rounded, smooth; from seven to eleven convex whorls, not in contact; about nine equidistant, rather thick, longitudinal, lamellar ribs continuous over sutures and angulated at sutural line; aperture rounded, with a reflected, lamellar border.

**Epitonium candeanum**<sup>199</sup> (d'Orbigny) (E. "*denticulatum* Sow.") Pl. 22, fig. 145

Alt., 18 mm. Shell white, not polished; apex acute, nuclear whorls smooth; about eight convex whorls, not in contact and spirally striate, with microscopic engraved, longitudinal lines which do not

<sup>196</sup> Gr., *mesos*, *meso*, middle.

<sup>197</sup> Lat., *nitidus*, *nitido*, shining; *scalae*, ladder.

<sup>198</sup> Gr., *epitonion*, peg, turncock; Lat., *angulatus*, angled.

<sup>199</sup> Named for Ferdinand de Candé.

cross the striations; nine to eleven subcontinuous, moderately elevated ribs, each with a sharp denticle near the suture above; one or two ribs on each whorl stronger and heavier than their fellows; aperture rounded; margin thickened.

On sandbars and sandy bottoms in moderate depths. East Coast. Doubtfully recorded from West Coast.

***Epitonium humphreysii* (Kiener)**

Pl. 22, fig. 146

Alt., 17 to 22 mm. Shell white, polished; apical whorl only without ribs; whorls about seven, convex, not in contact, smooth save for occasional growth lines; nine or ten well-elevated, fairly thin, lamellar ribs, continuous over sutures to apex; each rib with a definite angle and a notch at junction with opposite rib of preceding whorl; aperture rounded, with thickened marginal lamella; operculum pale amber; animal white; juvenile shells more pyramidal in outline than adult specimens.

On sand bars and sandy bottoms at moderate depths.

***Epitonium humphreysii* (Kiener) and eggs**

Pl. 46, fig. 320

One specimen of this *Epitonium* was taken by Alice Minor in Pine Island Sound in the act of laying. Each egg capsule about 1 mm. in diameter, more or less angular, of a greyish-white gelatinous substance, strung on a fine thread, and covered with minute particles of white sand. When fresh, these capsules could be slid back and forth on this thread, like beads. After removal from the water they crumbled like dried sponge when handled. The individual had laid about 100 of these capsule beads when discovered and continued laying in the aquarium, about 125 capsules in all.

***Epitonium rupicola*<sup>200</sup> (Kurtz)**

Pl. 45, fig. 318

Alt., 12 to 14 mm. Early whorls white, later whorls brownish; glossy but not highly polished; apical whorls smooth; six to eight contiguous whorls, moderately convex, with two spiral chestnut-brown bands—the lower more deeply colored and partly concealed by the suture in upper whorls; body whorl usually with elevated spiral line below periphery; from 13 to 19 cordlike, subcontinuous ribs, with heavier, more elevated ribs at intervals; aperture rounded,

<sup>200</sup> Lat., *rupes*, rock; *incolo*, to inhabit.

peristome thick and heavy with a decided flexure at junction of outer lip with body whorl.

Found with other Epitoniums.

**Epitonium multistriatum matthewsae**<sup>201</sup> (Clench and Turner)

Pl. 22, fig. 147

Alt., 12 mm. Shell white, glossy, imperforate; apical whorls smooth and translucent; seven or eight convex whorls, in contact; ribs are continuous, over upper three whorls they are close and threadlike, becoming more elevated and more widely separated on succeeding whorls; about 16 ribs on body whorl; the intercostal spaces are clearly engraved with fine, close spiral lines; aperture oval, margin thickened.

On sandy bottoms in two to six fathoms.

**Epitonium tollini** (Dall) Bartsch

Pl. 22, fig. 148

Alt., 10 to 15 mm. Shell white, glossy, elongate, slender; nuclear whorls smooth; eight or nine convex whorls, not contiguous; ribs lamellar, moderately elevated, equidistant, variable in number—from seven to eleven on body whorl; intercostal spaces without spiral sculpture; aperture slightly oval.

Sandy bottoms, moderate depths.

#### Family MELANELLIDAE

Members of the family Melanellidae belong, for the most part, to the fauna of tropical and subtropical seas; many species are native to West Indian, Caribbean, and Florida waters. Some Melanellidae are parasitic upon the integument or within the intestinal canal of echinoderms and holothurians, "where they creep about with much vivacity". Other species live in commensalism with sea urchins, and, according to P. Fischer, perhaps nourish themselves on the excrements of their companions.

The cephalic extremity of the mollusk is equipped with a retractile trunk, a pair of tentacles, and eyes at the outer base of each tentacle.

<sup>201</sup> Lat., *multi*, many; *striatus*, channeled. Subspecies named for Charlotta Matthews, of Sanibel Island.

The shells are small, smooth, and elegantly polished, generally elongate and produced to a sharp apex; the spire is frequently deflected from the vertical axis. The aperture is pyriform or oval and the operculum, when present, is corneous with a few spiral turns.

Genus **MELANELLA** Bowdich, 1822

*Melanellea conoidea*<sup>202</sup> (Kurtz and Stimpson)

Pl. 23, fig. 149

Alt., 10 mm., spire about .8 of altitude. Shell highly polished, white, translucent, imperforate, smoothly conic in outline. Apex acute; 13 flat whorls; body whorls subangulate at periphery; sutures faintly incised; aperture pyriform, widest at base, acute angled above; outer lip sharp; columella concave; operculum corneous, entirely closes aperture.

As observed in an aquarium, the mollusks are active and fearless. They move quite rapidly over the bottom sand or over the sides of a glass vessel, and by means of a mucous filament, secreted by a pedal gland, they are able to sustain themselves and creep beneath the surface film or on top of the surface of the water. The animal extends and retracts the long, mobile snout, but the head is rarely protuded beyond the shell's aperture. The pinpoint black eyes are easily seen through the translucent shell.

*Melanellea intermedia*<sup>203</sup> (Cantraine)

Pl. 23, fig. 150

Alt., 7-12 mm., spire about .7 of altitude. Shell polished, white—often brownish; slender, conic, sometimes slightly curved; imperforate; apex acute, 12 or 13 flattened whorls, body whorl evenly rounded; sutures not clearly defined; aperture pyriform, widest below; outer lip sharp; columella concave, produced into a thickening of lower lip margin.

Subgenus **LIOSTRACA**<sup>204</sup> H. and A. Adams, 1853

*Melanellea bilineata*<sup>205</sup> (Alder)

Pl. 23, fig. 151

Alt., 8 mm. Shell polished, white, often brownish at base; slightly flattened in antero-posterior diameter; imperforate; apex acute,

<sup>202</sup> Gr., *melanos*, black; *konocides*, conical.

<sup>203</sup> Lat., *intermediatus*, in the middle place.

<sup>204</sup> Gr., *leios*, smooth, *ostrakon*, shell.

<sup>205</sup> Lat., *bis*, twice; *lineatus* lined, striped.

nuclear tip rounded and prominent; about ten flattened whorls with two faint lines at middle and one below sutures; sutures fairly distinct; aperture entire, oval, outer lip sharp, columella concave.

**Melanella hemphilli** (Dall)

Pl. 23, fig. 152

Alt., 5 mm. Shell slender, conic, imperforate; chestnut-brown, polished and pellucid; apex acute, nuclear whorl prominent; about eight flat whorls; sutures distinct, a narrow line below sutures; aperture oval, narrow, entire, outer lip sharp, columella slightly concave.

Genus **NISO** Risso, 1826

**Niso interrupta**<sup>206</sup> (Sowerby)

Pl. 23, fig. 153

Alt., 14 mm. Shell conic-pyramidal, thin, polished, translucent; apex acute, 10 to 11 whorls, body whorls angulate at periphery; color pale cocoa-brown, with occasional flame-shaped patches of darker color; each whorl defined by a fine reddish-brown line; the sharp outer lip of oval aperture outlined by a similar pencilling; resting periods in the growth of the shell marked by reddish lines crossing whorls at sites of previous apertures; base of shell convex, deeply umbilicated by a conical depression; operculum pale yellow, entirely closing aperture.

Animal white, with long, slender tentacles, black eyes posterior to base of tentacles. Active and mobile, moves backward as readily as forward and can reverse position in its own length.

#### Family **PYRAMIDELLIDAE**

The name of this family, formed from the name of its genus *Pyramidella* (Lat., *pyramis*, pyramid), is suggestive of the characteristic shape of the shells which are pyramidal or conic in outline, turriculate, with an auriform or oval aperture and simple outer lip which is usually sharp. The columella may or may not be plicate. The operculum is corneous, adapted in shape to the aperture, and in the case of those species whose columella is plicate, the inner edge of the operculum is appropriately notched.

The apices of shells of the Pyramidellidae are heterostrophic. The embryonic shell, which forms the nucleus and the first one or

<sup>206</sup> Lat., *Nisus*, king of Megara ?; *interruptus*, interrupted.

more whorls of the spire, is coiled in the direction opposite to that of subsequent growth. The normal revolution of the whorls about the columella is dextral, the apical whorls are sinistral. Fischer stated that there is no known instance of complete sinistrosity among the group. In addition to this unusual character, the apical portion of the shell is tilted from the vertical axis, and the apex with some fraction of the immediately succeeding whorls is more or less depressed into the whorl next below.

The animals are provided with curious tentacles, shaped like the ears of a donkey and covered within their concavity and near the extremities with delicate, minute hairs which are continually in motion. A long, thick trunk can be extruded from an opening directly above the base of the tentacles, and just external to the base of the tentacles is a pair of sessile eyes.

Distribution of members of this group is general in warm seas from the intertidal zone to considerable depths. Most species inhabit sandy bottom.

Genus **PYRAMIDELLA** Lamarck, 1799

Subgenus **LONGCHAEUS** Mörch, 1875

**Pyramidella**<sup>207</sup> **crenulata** (Holmes)

Pl. 23, fig. 154

Alt., 15 mm., spire, 9 mm. Shell smoothly elongate-conic, imperforate; pale brown, polished, translucent, with irregular mottlings of darker and lighter coloring; columella dark brown; apex acute; 12 or 13 flat whorls, body whorl rounded; sutures horizontally channeled, V-shaped; interior slope and margin crenulate; aperture entire, reniform, outer lip sharp; columella sinuous, two oblique folds; basal margin of outer lip continued into a rounded cord encircling base to upper termination of columellar lip, where it becomes a prominent, flattened plication passing horizontally across the columella; operculum corneous, color of shell, notched to accommodate folds of columella.

Common on sandbars and sandy bottom in shallow water; dredged in Gulf of Mexico at two to six fathoms. Gulf specimens are often uniformly pink.

<sup>207</sup> Lat., *pyramis*, pyramid; *crenulatus*, finely notched.



Genus **TURBONILLA** Risso, 1826

Subgenus **STRIOTURBONILLA** Sacco, 1892

**Turbonilla**<sup>208</sup> **dalli** Bush

Pl. 23, fig. 155

Alt., 8 mm., spire, 6.25 mm. Shell milky white, glossy, elongate-conic; apex of about two nuclear whorls obliquely tilted from vertical axis; 12 convex whorls, the lower three slightly flattened; strong, slightly oblique axial ribs, not continuous over sutures, 16 to 18 on body whorl; intercostal spaces excavated, not extended to sutures and spirally striate with fine lines; sutures impressed, distinct, aperture simple, outer lip sharp, rounded; columellar lip straight, thickened, not plicate, upper margin oblique; axial ribs extend over base to umbilical region.

Found on sandy bottom at moderate depths.

**Turbonilla** **hemphilli** Bush

Pl. 23, fig. 156

Alt., 10 to 12 mm. Shell buff or pale brown with waxy lustre, often with wide, dark band below suture, apex acute with about two nuclear turns, obliquely tilted; 12 to 14 whorls, only slightly convex, flattened at periphery; sutures distinct, impressed; 18 or 19 almost vertical axial ribs, extending to, but not crossing sutures, interspaces about width of ribs, spirally striate; aperture like that of *T. dalli* to which the species is closely allied.

Found on sandy bottoms at moderate depths.

**Turbonilla** **conradi** Bush

Pl. 23, fig. 157

Alt., 10 to 12 mm. Shell buff or pale brown with waxy lustre, often with wide dark band below sutures; apex acute, two nuclear whorls almost transverse to vertical axis; 12 to 14 whorls, only slightly convex, lower whorl slightly overlaps one above; sutures incised, distinct; axial ribs not crossing sutures, 18 to 22 on body whorl, almost vertical, sometimes curved; intercostal spaces about width of ribs, spirally striate; base with three fine incised spiral lines and concentric striations; aperture as in other *Turbonillas*.

Mainly a littoral species.

<sup>208</sup> Lat., dim. of *turbo*, a top.

**Turbonilla<sup>209</sup> punicea** Dall

Pl. 23, fig. 153

Alt., 7-8 mm. Shell pale waxen-buff at tip, deepening to clear red-brown on body whorl; shape slender, elongate-conic; nuclear whorls transverse; 12 or 13 whorls, slightly and evenly convex; sutures narrow, incised; 16 to 18 strong, nearly vertical ribs, almost obsolete on body whorl; interspaces about width of ribs, with fine, closely placed spiral striations; aperture entire, columellar lip thickened.

Moderate depths on sand and mud bottoms.

**Turbonilla<sup>210</sup> incisa constricta** Bush

Pl. 23, fig. 159

Alt., 6-8 mm. Shell waxen-buff, spire almost unicolored, dark band over lower portion of whorls; shape slender, elongate-conic; one and a half smooth nuclear whorls tilted obliquely to vertical axis; ten flattened convex whorls; postnuclear whorl with fine, close vertical threads; next whorl shows stronger threads with beginning definition of interspaces; succeeding eight whorls show increasing strength of ribs and intercostal striations; about 25 ribs on body whorl. With magnification, the intercostal striation is seen to consist of six to eight flattened cords which do not cross the ribs and which are separated by excavated interspaces of almost equal width. Aperture typical.

Found with *T. punicea* and other Turbonillas of moderate depth range.

Genus **PERISTICHIA** Dall, 1889

**Peristichia<sup>211</sup> toreta** Dall

Pl. 23, fig. 160

Alt., 10.5 mm. Shell white or yellowish, elongate-conic; two smooth, glassy nuclear whorls tilted more than transversely from vertical axis; 13 slightly convex whorls with strong, beaded, spiral sculpture; sutures distinct, wide, with a fine, undulating thread above the middle. Each whorl shows above the suture a roundly beaded spiral cord, above this cord is an interspace of almost equal

<sup>209</sup> Lat., *punicus*, red, purple.

<sup>210</sup> Lat., *incisus*, cut; *constrictus*, drawn together.

<sup>211</sup> Gr., *peri*, around; *stickos*, a row or line.

width, next above is a second beaded spiral of size almost equal to the first, next a narrower interspace and a third, smaller beaded spiral immediately adjacent to the suture. Axial ribs over each whorl cross the interspiral spaces and extend as radii over the rounded base. A strong fold from the top of the columella is continued around base of shell to form the lowest crenulation of outer lip. Aperture ovate, outer lip sharp, crenulated by external sculpture, three internal lirae; operculum pale yellow, animal white.

From three to six fathoms.

Genus **ODOSTOMIA** Fleming, 1817

**Odostomia**<sup>212</sup> *acutifens* Dall

Pl. 46, fig. 321

Alt., 4; alt. of spire, 1.6 mm. Shell yellowish white, glossy, solid, pyramidal with aperture extended beyond base; apex acute; five or six rounded whorls, base of body whorl rounded; sutures defined but not channeled; whorls without sculpture save for growth lines; aperture entire; outer lip sharp, rounded into columella below; columella distinct with polished callus above, one sharp, horizontal, almost median tooth; a groove posterior to columella but no umbilicus.

This *Odostomia* is not common; it inhabits muddy flats.

Subgenus **MENESTHO** Möller, 1842

**Odostomia** *bisuturalis*<sup>213</sup> Say

Pl. 23, fig. 161

Alt., 4; alt. of spire, 3 mm. Shell elongate, conic-pyramidal, base extended; milky white; thin pale-brown epidermis; apex of about two whorls partly embedded in first postnuclear whorl; seven or eight flattened whorls, shouldered at sutures; sutures well defined. A strong, deeply cut spiral, parallel with suture, is engraved on upper portion of each whorl. Aperture oval, upper angle acute, base rounded into slender columella which has one oblique fold well within aperture; operculum corneous, brown.

Inhabits muddy sand flats.

<sup>212</sup> Gr., *odon*, *odontis*, tooth; *stoma*, a mouth; Lat., *acutus*, acute; *dens*, tooth.

<sup>213</sup> Lat., *bis*, twice; *sutura*, sew or stitch—seam.

**Odostomia impressa**<sup>214</sup> Say

Pl. 23, fig. 162

Alt., 4 mm. Shell milky white, elongate-conic; small nuclear whorls partly embedded in succeeding turn; six or seven flattened-convex whorls, outline indented by sculpture; sutures channeled; themselves impressed with delicate spiral striations; aperture ovate, whorls sculptured with three equidistant, deeply cut spiral grooves, simple, angled above; outer lip sharp. The outer lip of adult shells is somewhat flaring, aperture narrowed within. Columella has one oblique fold. Base shows about seven narrow spiral grooves.

*O. impressa* is generally found about oyster bars among clumps of oysters.

Egg capsules of **Odostomia impressa** Say

Pl. 46, figs. 322a, b

**Odostomia trifida**<sup>215</sup> Totten

Pl. 23, fig. 163

Alt., 4 to 5 mm. Shell white, glossy, thin, translucent; yellowish periostracum; conic-ovate; nuclear whorls small, partly embedded in following turn; eight whorls, moderately convex, slightly shouldered at summit; sutures distinct; sculpture of three deeply cut inequidistant, and one faint spiral line; aperture elongate-oval, upper angle acute; outer lip thin, its interior showing reverse of external sculpture; columella with one strong oblique fold above middle; base rounded, narrowed below, impressed with about 10 unequal, inequidistant striae; operculum corneous, brown.

Inhabits mud and sand flats, often among sea grasses.

Subgenus **CHRYSTALLIDA** Carpenter, 1856

**Odostomia seminuda**<sup>216</sup> (C. B. Adams)

Pl. 23, fig. 164

Alt., 3.75 to 4 mm. Shell elongate-conic; milky white, glossy; about two smooth nuclear whorls obliquely embedded in next succeeding whorl; six or seven slightly convex whorls, shouldered at summit, body whorl rounded; sutures distinct; whorls sculptured between sutures by axial ribs cancellated into beads of nodules by four low, broad, equidistant ridges; aperture somewhat auriform, outer lip simple, thick within, thin at edge, showing external sculp-

<sup>214</sup> Lat., *impressus*, pressed.

<sup>215</sup> Lat., *trifidus*, three-cleft.

<sup>216</sup> Lat., *semi*, half; *nudus*, naked.

ture reversed in relief; columella flexuose with a strong oblique fold well within aperture; base and body whorl below periphery engraved with clear-cut spiral grooves; operculum pale brown.

Associated with other Odostomias.

All members of this family have shells with reverse apex but animal is dextral, specimens of veligers are easily recognized in the plankton. Known eggs are either enclosed in irregular gelatinous mass or in small lenticular capsules. Eggs 0.24-0.35 mm. diameter. Very thin-walled lens-shaped capsules attached by the lower surface. Four to 8 ova in each capsule. The young hatch with transparent, colorless, sinistral shell, of 1 whorl. Veliger has bilobed velum.—Marie Lebour.

#### Family NATICIDAE

The family Naticidae is one of the subdivisions of the Mollusca called Platypoda, which means "broadfoot". The propriety of the name is evident when individuals of the species *Natica*, *Polinices*, or *Sinum* are seen ploughing through the sandy sea bottom in quest of prey.

Characteristic of the group is the highly distensible oval foot which overflows and almost conceals the entire shell when the animal is expanded. A well-developed cephalic disc, or propodium, is reflected over the head of the animal and the anterior border of the shell. The sense of smell and touch are apparently keen, but eyes are absent or subtegumental. The radula is well developed in all species of the Naticidae, and by its use a neat round hole is drilled through the umbonal region of the shells of bivalve mollusks which constitute the food of this voracious and predatory race.

The shells are subglobular or depressed and auriform, the body whorl is much expanded and the aperture correspondingly large, not canaliculate, with a simple, sharp outer lip.

The group has a wide distribution from Arctic to Antarctic seas.

#### Genus NATICA Scopoli, 1777

*Natica*<sup>217</sup> *canrena* (Linné)

Pl. 24. figs. 165a, b

Alt., up to 45 mm. Shell subglobular, smooth; adult specimens thick; apex small, spire depressed, body whorl expanded; pale and deep fawn color disposed in revolving bands, with zigzag markings of dark brown, strongest over upper part of shell; base white; thin,

<sup>217</sup> Lat., *natica*, buttock.

glossy periostracum; aperture semilunar, simple; columella oblique, reflected, notched at umbilicus; deep umbilicus more or less filled with entering callus; operculum calcareous, internal surface fawn color, externally white with about six deeply cut channels parallel with external margin; columellar margin finely serrate.

Inhabits sandy bottoms beyond low tide mark. Animal preys upon bivalves and has been seen to devour dead fish.

*Natica pusilla*<sup>218</sup> Say

Pl. 24, fig. 166

Alt., 4-6 mm. Shell small, sturdy, subglobular; spire depressed, body whorl large; color white or a shade of fawn, with faint chestnut markings and obscure bands; aperture semilunar, outer lip sharp; columella oblique, thick; reflected columellar callus pressed into umbilicus which appears as an arcuate depression; operculum calcareous, smooth.

This smallest of the Florida Naticas is often confused with young *N. canrena*. Its depth range is from low water mark to 15 fathoms.

Egg collar of *Natica pusilla* Say

Pl. 46, fig. 323

Genus **POLINICES** Montfort, 1810

*Polinices lacteus*<sup>219</sup> (Goulding)

Pl. 46, fig. 324

Alt., 25 mm. Shell rounded, obliquely ovate; white, thin yellowish epidermis, spire depressed, body whorl expanded; sutures distinct; surface smooth, faint growth lines; aperture semilunar; columella oblique; heavy reflected callus partly filling deep umbilicus; operculum corneous, amber or claret color.

Dredged in four to six fathoms.

*Polinices duplicatus*<sup>220</sup> (Say)

Pl. 24, fig. 167

Alt., 45 mm; largest Gulf specimen measured, alt. 62, diameter 74 mm. Shell subglobular, smooth; spire more or less depressed, much individual variation in this character; body whorl large, sutures distinct; color bluish or ashy gray, not always uniformly

<sup>218</sup> Lat., *pusillas*, very small.

<sup>219</sup> Gr., *Polynices*, son of Oedipus; Lat., *lacteus*, milky.

<sup>220</sup> Lat., *duplicatus*, doubled.

tinted; a dark presutural band about first few whorls; surface smooth, fine growth lines; thin, glossy periostracum; aperture semilunar, outer lip sharp, protracted above; columella oblique; umbilicus deep, partly closed by dark-colored callus; interior of aperture usually dark-colored, lustrous; operculum corneous, dark-amber color.

Found with *N. canrena* up to about three fathoms.

Genus **SINUM** Röding, 1798

***Sinum perspectivum***<sup>221</sup> (Say)

Pl. 24, fig. 168

Shell auriform, depressed to altitude of a few millimeters; greatest diameter of base approximates 35 millimeters; apex and spire flattened to plane of body whorl; color milk-white; thin, yellowish, papery epidermis; about three whorls; sutures faintly impressed; surface sculpture of numerous well-engraved, subequidistant, revolving, slightly wavy lines and fine longitudinal lines of growth; aperture wide, rounded; outer lip sharp, finely crenulate; operculum corneous, minute.

In the living animal, only a small portion of the upper surface of the shell is exposed.

Sandy bottom in shallow water.

***Sinum maculatum***<sup>222</sup> (Say)

Pl. 47, figs. 325a, b

Shell a little smaller and less depressed than *S. perspectivum*, with two maculated bands of chestnut-brown about the upper whorls.

Family **LAMELLARIIDAE**

The mollusks which constitute this family bear shells which are similar in general characters to those of the genus *Sinum*, but much smaller, more delicate in structure, and without an operculum. The shells are almost or wholly covered by a reflection of the mantle.

The animals are carnivorous and are usually found in association with compound ascidians, Hydrozoa and Alcyonaria; their eggs are deposited among the folds and in the crevices of colonies of these animals. Some of them are brightly colored and their general appearance is usually more suggestive of a nudibranch or a platyhel-

<sup>221</sup> Lat., *sinus*, a bend or hollow; *perspectivus*, *perspicere*, to look through.

<sup>222</sup> Lat., *maculatus*, spotted.

minth than of a shelled mollusk.

Distribution of the family is chiefly in cold seas, but some species are native to warm waters.

Genus **LAMELLARIA** Montagu, 1815

**Lamellaria cochinella**<sup>223</sup> L. Perry

Pl. 47, fig. 326

Alt., 6; greatest diam., 4; greatest thickness, 3; height from upper angle of aperture to apex, 1.5 mm. Shell auriform oblique; pure white with glossy, diaphanous epidermis; apex and succeeding whorl extremely small; nucleus depressed; second whorl larger, convex; body whorl convex, widely expanded; sutures incised, distinct. Above periphery of body whorl are two faint, revolving, incised lines, with a less distinct, interrupted line nearer suture; delicate incremental lines form longitudinal striations over entire surface. Aperture wide, entire; sharp outer lip somewhat protracted into a thin callus over lower convexity of whorl above; columella evenly concave.

A number of individuals of this species were found associated with colonies of compound ascidians dredged in four to six fathoms off Captiva and Sanibel Islands, Florida. The mollusk is brilliant red or milky white. The reflected mantle entirely covers the shell. The general appearance of the animal and its undulating movement suggests a nudibranch or a flatworm more than a shelled mollusk.

**Lamellaria leucosphaera**<sup>224</sup> Schwengel

Pl. 47, figs. 327a, b

Alt., 16 mm.; diam., 15 mm.; thickness 11 mm. Shell naticoid, thin, transparent, with a slight milky cloudiness, smooth, shining and faintly iridescent; nucleus small, flat and glassy, of about one-fourth whorls, followed by two abruptly larger, convex whorls, suture impressed; sculpture of fine incremental lines; aperture broad, ovate, nearly two-thirds the size of shell; columella concave, spirally gyrate, allowing a view up the spire from the base of the shell.

Description of the animal was made from a living specimen, observed closely over a period of days by Louise M. Perry.

Length 20 mm., width 15 mm., height at center 16 mm. In external appearance the animal is grayish, jelly-like, oval in outline, gently and

<sup>223</sup> Lat., dim. of *lamina*, plate, leaf, layer; Fr., *cochinille*, Castilian red.

<sup>224</sup> Gr., *leucos*, white; Lat., *sphaera*, globe.



symmetrically rounded to a central, elevated summit where the shell is visible through the semi-transparent mantle. The mantle completely covers the body and the shell, whose apex is seen posteriorly at the right. Structural details of the dark liver are visible through mantle and shell.

The mantle is grayish, semi-transparent; its free edges are thin and delicate, rounded behind, slightly 'frilled' at the sides where there are three indentations or slits. These slits may be deepened by contraction of the body of the mantle. Directly in front, the mantle has a deep central fissure whose edges are folded and reflected to form a siphonal canal which is directed forward and upward at an angle near 25 degrees. This siphonal canal can be lengthened or shortened and widened.

The outer surface of the mantle is peppered with small black dots tending to circular grouping and surrounded by numerous granular appearing, refractile, white 'sugar grains'. Less numerous and irregularly placed are clusters of these dots conically elevated above the general surface level. The free edges of the mantle are thickly covered with minute pin dots like fine sugar crystals, slightly refractile, as are those over the body of the mantle. The dots are entirely absent from the mantle's inner surface. Under low magnification the entire surface of the mantle appears finely granular throughout its thickness. Its whole surface is sensitive to touch.

**Lamellaria koto**<sup>225</sup> Schwengel

Pl. 47, fig. 328

Alt., 16.4 mm.; length, 18 mm. This *Lamellaria* is similar in shape to *Lamellaria leucosphaera* but is slightly larger in all measurements, the body whorl much less globose and the aperture comparatively larger. Also the spire is higher, the sutures more deeply impressed giving each whorl a more rounded appearance. The shell is a milk-white, instead of clear transparent, and the male animal is milk-white, while the female animal is a dull gray.

Genus **MARSENINA** Gray, 1852

**Marsenina globosa**<sup>226</sup> L. Perry

Pl. 24, fig. 169

Alt. from base of columella, 14; from base of expanded lip, 15.5; greatest diam., 14; extreme thickness, 9.25 mm. Shell thin, translucent, milk-white; glossy, diaphanous epidermis; apex and apical whorls small, extremely thin; two small whorls, the second enlarging abruptly into body whorl which constitutes about eight-tenths of the extreme altitude; whorls oblique, convex, inflated; sutures impressed; surface shows only fine incremental lines; aperture wide, obliquely expanded; outer lip thin, sharp; columella incurved,

<sup>225</sup> Named for Alfred S. Koto.

<sup>226</sup> Lat., *globosus*, globular, spherical.

concave at center; interior smooth, iridescent; sutural impressions and cavity of spire visible when shell is viewed from base through umbilicus.

Holotype\* collected by Jeanne S. Schwengel from Pine Island Sound, Florida.

#### Family XENOPHORIDAE

A most extraordinary habit of the mollusks of this family is intimated by the name of its genus *Xenophora*. The word is a compound of the Greek combining form *xeno* from *xenos*, guest or stranger; and *phoros*, from *phorein*, to bear. Only the deep water species of *Xenophora* fail to disguise their shells externally by attaching to them foreign objects, such as shell valves, coral, and fragments of rock. When the animal is at rest upon the sea bottom only a small mass of rough debris is to be seen, not in the least suggestive of the active, intelligent mollusk that so protects itself.

The animals also present a remarkable combination of physical characters; they possess the foot of *Strombus*, the radula of *Calyptraea*, an operculum similar to that of *Thais* and shells which resemble in shape those of *Trochus*.

Distribution of the family is confined to warm seas.

Genus **XENOPHORA** Fischer de Waldheim, 1807

***Xenophora conchyliphora***<sup>227</sup> (Born)

Pl. 24, fig. 170

Alt., 35; diam. of base about 40 mm. Shell is trochiform, imperforate, apex sharp; whorls flattened, base slightly concave, body whorl sharply carinate at union with base; surface roughly striate from growth lines; color variegated brown and cream, base brown; aperture symmetrical, large, oblique; outer lip sharp and continuous with carina of body whorl; columella short, stout, curved; operculum corneous, suboval, thin, slightly concave. Characters of shell above the base are concealed by the agglutinated strangers affixed in fairly regular rotation about the whorls. Shells, bits of rock, living or dead coral are indiscriminately utilized, but preference seems accorded to valves of pelecypod shells. These are always attached by their convex surface.

<sup>227</sup> Gr., *xenos*, combining form meaning guest, stranger; *phorein*, to bear; *konche*, shell.

\* Single specimen taken as the type by the original author.

Several living *X. conchyliophora* kept in an aquarium, affixed only left valves of *Chione cancellata* to their shells, although other bivalve shells and bits of gravel were available. Additions to the defensive armor were made at night, suggesting that the species may be nocturnal in habit.

Living specimens dredged in three to six fathoms on gravelly bottom about reefs.

#### Family CALYPTRAEIDAE

Distribution of members of this family is common to all seas, from shallow water to considerable depths.

The mollusks are sedentary and adhere tenaciously to the surfaces of rocks or shells where they become accidentally located in the early stages of their growth. That portion of shell or stone immediately beneath the foot of the animal often becomes dissolved or worn away, leaving an oval depression.

#### Genus CALYPTRAEA Lamarek, 1799

*Calyptraea centralis*<sup>228</sup> Conrad

Pl. 24, figs. 171a, b

Alt., 2; diam. of base, 5.5 mm. Shell thin, conic, cap-shaped; white, with transparent epidermis; apex sharp, excentric, spiral, tilted from vertical, nuclear whorls glassy; sculpture of growth lines concentric to round base; sometimes fine radial striations from apex to base; basal aperture round, margin sharp; interior polished; thin spiral septum from base to apex; mollusks adherent to other shells.

In depths of one to more than fifty fathoms.

Triangular capsules covered by front part of parent's shell until they hatch in crawling stage. Capsules fixed in a bunch by their narrow ends to a stone or shell. They are transparent, colourless, 3 to 3½ mm. long, 12 to 25 ova in each capsule, floating in intra-capsular fluid. Eggs are usually concentrated at broad end of the capsule—Marie Lebour.

#### Genus CRUCIBULUM Schumacher, 1817

*Crucibulum striatum*<sup>229</sup> (Say)

Pl. 24, fig. 172

Alt., 12; diam. of base, 25 mm. Shell conic, cap-shaped; apex laterally excentric, beaked; anterior declivity of shell convex, pos-

<sup>228</sup> Gr., *kalyptra*, covering for the head; Lat., *centralis*, center.

<sup>229</sup> Lat., *crucibulum*, an earthen pot; *striatum*, striped.

terior concave; color brown or brownish. A smooth area about summit defined by a sutural line indicates early spiral growth; below this line are feeble radiating ribs. Basal aperture, somewhat oval, margin finely crenulate; interior polished, brown; a white, funnel-shaped internal septum below apex; animal adherent, shell free.

From about three to more than a hundred fathoms.

#### Family CREPIDULIDAE

The distribution of this family is world-wide throughout warm seas at moderate depths. The adult mollusks are always affixed, probably permanently; the shell is not attached and, like *Anomia*, varies considerably in its form by reproducing any irregularities of the surface it rests upon.

The ova are deposited in grapelike bunches and retained beneath the shell until the larvae emerge. The animals of *Crepidula* undergo a change of sex during the process of normal growth; in young stages male attributes predominate, but as development proceeds this reversal of sex becomes complete. Groups of *Crepidula* may contain small male individuals, some in transitional stages and others which have attained full reproductive maturity.

#### Genus CREPIDULA Lamarek, 1799

*Crepidula fornicata*<sup>230</sup> (Linné)

Pl. 25, fig. 173

Length to 40; width to 26 mm. Shell oval, oblique, with rounded margins and flattened spire; apex inclined to right, submarginal; body whorl constitutes almost entire shell. Color varies through shades of brown, frequently arranged in stripes or blotches; thin yellowish epidermis. Surface shows only growth lines; interior polished, mottled purple-brown and white; internal horizontal diaphragm is concave, white, translucent, extending to middle of aperture, its free margin slightly sinuous. Convexity and consequent depth of shell are variable, some individuals are flattened, others highly convex. Adherent to the outer, convex, surface of other shells; sometimes in tiers of successively smaller individuals.

From one to six fathoms.

<sup>230</sup> Lat., *crepidula*, a small sandal; *fornicatus*, vaulted.

Egg capsules of *Crepidula fornicata* (Linné) Pl. 47, figs. 329a, b, c

*Crepidula maculosa*<sup>231</sup> Conrad Pl. 48, fig. 330

Length, 32 mm., breadth, 25 mm. Nearly oval, convex, smooth, with faint growth lines; creamy white, with brownish spots irregularly interspersed; interior white, thin enough to show spots faintly through the shell; diaphragm less than half the opening, the margin being slightly concave.

This *Crepidula* has formerly been grouped with *C. fornicata*, but upon closer examination is found to be uniformly ovate, the diaphragm extending into the apex and regularly of less height comparatively, than in *C. fornicata*.

*Crepidula glauca*<sup>232</sup> *convexa* Say Pl. 48, fig. 331

Length, 12; width, 8 mm. Shell resembles *C. fornicata* but is much smaller, more convex, side of shell toward which apex inclines is more nearly vertical. Internal septum deep-seated and convex.

Found attached to the convex surfaces of other shells. The authors have seen great numbers of these small mollusks attached to blades of eel grass on the tidal flats of Sanibel Island.

*Crepidula plana*<sup>233</sup> Say Pl. 25, fig. 174

Length to 30; width to 16 mm. Shell flattened, oblong-oval, white; yellowish epidermis; apex terminal, directed to left, depressed to surface plane; smooth but for coarse growth lines; interior polished; diaphragm almost half the length of shell, highly convex toward free margin, edge concave at center, usually notched at one side.

*C. plana* may be attached to almost any submerged object; within bottles, to the interior of univalve shells, on oyster and scallop shells and attached to the upper surface of shells of its own species. Wherever the mollusks may be attached, the growing shell becomes adapted to the curvature and sculpture of its resting place—externally concave within the apertures of univalve shells, ribbed

<sup>231</sup> Lat., *macula*, spotted.

<sup>232</sup> Gr., *glaukos*, green-blue.

<sup>233</sup> Lat., *planus*, level, flat.

on scallop shells, margins indented when some obstacle to lateral growth is encountered.

Its depth range appears to be considerable.

*Crepidula aculeata*<sup>234</sup> (Gmelin)

Pl. 25, figs. 175a, b

Length, 20-30 mm. Shell with general characters of other *Crepidulas*; outer surface with irregular, radiate, tuberculate or spiny ribs; color brown or brownish; interior polished, brown and white, diaphragm white.

From one to seven fathoms.

#### Family TRUNCATELLIDAE

The mollusks of this family generally make their habitats about the shores of warm and temperate seas. They are able to remain for many days out of water and some species have become almost terrestrial.

Genus *TRUNCATELLA* Risso, 1826

*Truncatella pulchella*<sup>235</sup> Pfeiffer

Pl. 25, fig. 176

Alt., 7 mm. Shell cylindrical, slightly narrowed toward truncate apex; pale-amber color with transparent epidermis; about four flattened convex whorls, axially ribbed, ribs strongest near the impressed sutures; body whorls slightly carinate below; aperture oval, a little oblique; outer lip reflected; columellar lip thickened; operculum corneous, pale brown.

Abundant on weedy bottoms of littoral regions; often found beneath logs or stones.

#### Family RISSOINIDAE

The Rissoinidae is a family of small marine mollusks native to warm and temperate seas and to moderate depths.

Genus *RISSOINA* d'Orbigny, 1840

*Rissoina bryerea*<sup>236</sup> (Montagu)

Pl. 25, fig. 177

Alt., 5-5.5 mm. Small, rather thick, fusiform shells; white or

<sup>234</sup> Lat., *aculeatus*, from *acus*, needle.

<sup>235</sup> Lat., *truncatus*, truncated, cut off; *pulchella*, very pretty.

<sup>236</sup> Dim. of *Rissoa*, genus dedicated to the naturalist Risso; Lat., *bryon*, moss.

faintly yellowish with thin epidermis; apex acute, nuclear whorls smooth; six or seven convex whorls; sutures shallow; 16 to 20 strong axial ribs; equal, smooth interspaces; aperture oval, entire; outer lip thick, a little flaring; operculum corneous, pale brown, having an internal apophysis which articulates with columellar lip.

Abundant on grassy bottoms in shallow water. Often found on eel grass.

**Rissoina laevigata**<sup>237</sup> (C. B. Adams)

Pl. 48, fig. 332

Alt., 4 mm. Shell fusiform, small, smooth, glossy, pellucid white, sometimes with opaque spots; thin, transparent epidermis; apex small, prominent; nine or ten slightly convex whorls; sutures shallow, incised, with opaque borders; aperture oval, entire; outer lip thick, a little flaring; operculum corneous, light-amber color.

Less common than *R. bryerea*. Found on grassy bottom beyond littoral zone.

#### Family SKENEIDAE

The Skeneidae is a family of small mollusks including genera distributed from Greenland to Florida and the West Indies.

#### Genus ADEORBIS Wood, 1842

**Adeorbis beau**<sup>238</sup> P. Fischer

Pl. 25, figs. 178a, b

Alt., 4.75; extreme diameter of base, 11.5 mm. Shell rather thick, pure white, flattened, almost discoid; about three whorls; sutures channeled, body whorl sharply keeled at periphery and base; spiral sculpture of five, nearly equidistant strong ribs, with fine threadlike ribbing in interspaces. Between suture and uppermost strong rib is a broader band of fine ribbing; between peripheral and basal ribs, the surface is smooth, showing only lines of growth; aperture rounded, entire; base with delicate spiral and growth lines; deep, funnel-shaped umbilicus open to apex; operculum corneous, light brown.

Occasionally found on beaches. Dredged in three fathoms.

<sup>237</sup> Lat., *laevigatus*, made smooth.

<sup>238</sup> Lat., *ad*, to, toward; *orbis*, circle; dedicated to M. Beau, friend of P. Fischer.

## Family LITTORINIDAE

This is a family of widely distributed, amphibious mollusks, living in the littoral zone, often above high tide mark.

The animals are remarkable for the curious foot; the plantar surface of the foot is centrally divided by a longitudinal cleft, and the two sides are alternately advanced when the creature is in active motion.

## Genus LITTORINA Ferrusac, 1822

*Littorina mespillum*<sup>239</sup> (Megerle von Mühlfeld) Pl. 25, fig. 179

Alt., 10 mm. Shell spiral, subglobose, smooth; chestnut color, either unicolored or banded with darker shade; apex sharp; about three convex whorls; aperture rounded, entire; outer lip simple; columella rather thick, flat; shallow umbilical depression; operculum corneous.

## Subgenus MELARAPHE (Megerle von Mühlfeld) Menke, 1828

*Littorina angulifera*<sup>240</sup> (Lamarck) Pl. 25, fig. 180

Alt., 25-30 mm. Shell thin, conic, imperforate; apex acute, about six convex whorls; slightly channeled sutures; ground color cream, with flammules of dark brown above and below the sutures, oblique brown bands on body whorl and revolving pattern of brown dashes; spiral sculpture of irregular, inequidistant engraved lines; aperture rounded oval; outer lip thin, sharp, protracted above; columella with central groove in lower portion; operculum corneous, amber color, thin and flexible.

Common above high tide mark on branches of mangrove trees, old wharves and pilings.

## Family TURRITELLIDAE

The shells of the Turritellidae are well described as "little towers," since the spire surmounts the body by many times its height.

Distribution of the family includes all seas.

<sup>239</sup> Lat., *litus*, the seashore; *mes*, middle; *pilus*, a hair.

<sup>240</sup> Lat., *angulus*, angle, corner; *ferre*, to bear.



Genus **TURRITELLA** Lamarck, 1799**Turritella subannulata** acropora<sup>241</sup> Dall

Pl. 25, fig. 181

Alt., 30-42; diam. of base, 7-10 mm. Shell regularly conic, imperforate; spire elongate, apex acute; 15 flattened whorls with distinct median keel, less prominent on lower whorls; sutures not well defined; color whitish, pinkish, or pale violet, more or less patterned with longitudinal brown flammules, and brown dots upon the spiral ridges; nucleus pink in living specimens. Sculpture over whorls and base of closely placed primary and secondary spiral ridges and fine microscopic striations. Aperture rounded, entire, oblique in relation to vertical axis of shell; outer lip thin, protracted above; columella thin, concavely curved; operculum corneous, thin, amber color.

Dredged living in three to six fathoms south of Sanibel Island to Little Carlos Pass, Florida.

**Turritella exoleta**<sup>242</sup> (Linné)

Pl. 48, fig. 334

Alt., 45 to 75 mm.; diam. at base, 13 to 15 mm. Shell regularly conic, imperforate; spire elongate, apex acute; 18 to 20 concave whorls, heavily ridged above and below; sinuated growth lines, with occasional thin laminations; color white to yellowish with flammules of chestnut-brown, curved with the growth lines; fine continuous spiral lines on concave area of whorls. The last whorl has a double ridge. Aperture large, rounded from the base to the thin outer lip which is sinuous in the middle; lower edge straight; operculum corneous, thin, amber color.

Dredged living in five to seven fathoms.

Family **VERMETIDAE**

Both the mollusks of this family and their shells differ strikingly from others of their kind. The animal is vermiform and elongated, and the loosely coiled shell protects the wormlike body in its entire length. The mollusks are entirely sedentary, and the shells are usually attached to coral or rock, growing within sponges, or—as is the habit of *Vermicularia fargoii*—gregarious, living in

<sup>241</sup> Lat., *turris*, tower; *sub*, under, below; *annulus*, ring; Gr., *akros*, end, extremity; *poros*, passage, pore.

<sup>242</sup> Lat., *exolesco*, to grow to full size.

colonies with the coils of the shells intertwined.

The animal has short tentacles and snout, eyes placed on the outer sides of the tentacles. They are unisexual, and fertilization of the ova is accomplished by water-borne sperm.

One of the marine snails called *Vermetus* feeds in a manner peculiar to itself. It has largely lost the power of movement but uses the mucus, which such creatures normally employ to lubricate their movements, to catch its food, throwing out a sheet of sticky mucus in which fine particles and animals are entangled, and after a time drawing this with the collected food back into its mouth.<sup>243</sup> Perry has seen *V. fargoii* in an aquarium feed in this manner.

Shells of the Vermetidae are free or fixed. The young shells are regularly spiral, easily confused with *Turritella*, after an inch or less of growth, the whorls become more and more irregular and loosely coiled, gradually increasing their diameter. The aperture is round; a circular, corneous operculum is usually present.

Distribution is confined to warm and temperate seas.

Genus **PETALOCONCHUS** H. C. Lea, 1843

***Petalconchus irregularis*** (d'Orbigny)

Pl. 26, fig. 182

This is a reef-building species. Dr. W. H. Dall observed patches 20 to 30 feet across, with tops nearly at water level and scarcely dry at low tide. The individual shells are loosely coiled, contorted and inextricably intertwined—only the juvenile tips show any regularity of growth. The external surface usually bears longitudinal ribs which are wrinkled and roughened by circular growth lines. The aperture is round, sharp. Color is reddish chestnut, whitened by calcareous deposits; interior smooth, highly polished.

Genus **VERMICULARIA** Lamarck, 1799

***Vermicularia***<sup>244</sup> ***knorri*** (Deshayes in Lamarck)

Pl. 26, fig. 183

Found living in sponge. Shell is translucent, septate within early whorls. Color brown, purple, pink or white corresponding to color and shade of individual mollusk. Apex is sharp, about five white, acutely carinate, contiguous whorls, followed by loose coils

<sup>243</sup> The Seas, Russell and Yonge.

<sup>244</sup> Lat., *vermis*, worm.

becoming increasingly more distant and irregular. Longitudinal sculpture of one strong keel continuous with carina of juvenile whorls; on one side of this keeled rib is a series of small ribs separated by finely ribbed interspaces, threadlike ribbing over remainder of surface; wrinkled annular growth lines. Aperture round; sharp oblique margin; diameter about six millimeters. Small, concave, corneous operculum.

**Vermicularia fargoi**<sup>245</sup> Olsson (*V. spirata* Philippi) Pl. 26, fig. 184

Color brown, paler toward aperture. Apex of juvenile shell acute, nucleus glassy; about six regular whorls preceding the long loosely coiled portion of shell. Sculpture of longitudinal ribs which form definite keels; smaller parallel ribs and fine interspatial striations; rough, annular growth lines. Aperture round, diameter eight to twelve millimeters. Operculum corneous, circular, entirely closes aperture.

*V. fargoi* is eaten by *Fasciolaria hunteria*; *Trivia pediculus* has been seen by Perry to devour large numbers of the veligers of *Vermicularia*.

#### Family CAECIDAE

This is a group of minute mollusks generally distributed through warm and temperate seas at moderate depths. The shells are not likely to be found unless carefully looked for in sifted sand or accumulations of fine detritus on the beaches between tide levels and the sand which may be shaken from sponges.

The embryonic shell is a spiral of two or three whorls, succeeding development is into a horn-shaped tube—the bovi-cornu stage. These juvenile phases of the shell are successfully truncated as further growth proceeds; the shell when adult is small, tubular, arcuate, with a circular aperture and an externally convex septum which closes the apical end.

Genus CAECUM Fleming, 1813

**Caecum**<sup>246</sup> *floridanum* Stimpson Pl. 26, fig. 185

Length, 2; diam., 6 mm. Shell white, arched; from 20 to 30

<sup>245</sup> Named for William Fargo; Lat., *spira*, a coil.

<sup>246</sup> Lat., *caecus*, blind.

sharp, elevated, annular ribs separated by interspaces which become wider toward aperture and are finely, longitudinally striate. The apical septum is slightly convex with minute, laterally placed mucro. Corneous operculum.

***Cacum carmenensis* de Folin**

Alt., 2; at summit, 3; diam. at base, .55 mm. Shell white or whitish; conic, regularly increasing in diameter from summit to base; slightly swollen toward aperture; aperture always contracted, margin not thickened, oblique; surface with fine, delicate, transverse striations. The septum is characterized: claw-shaped, directed to right of plane of truncation; lateral margin nearly straight; operculum?

Genus **MEIOCERAS** Carpenter, 1859

***Meioceras nitidum*<sup>247</sup> (Stimpson)**

Pl. 26, fig. 186

Length, 2-2.5; diam. at center, .75 mm. Shell small, polished, translucent, brown or brownish, arcuate, dorsal convexity greatest; aperture circular, oblique, sharp-edged; apical end smaller; apical plug convex; operculum corneous.

Often found on eel grass.

Family **MODULIDAE**

Members of this family are native to warm seas. Three species are recorded from Florida.

Genus **MODULUS** Gray, 1842

***Modulus*<sup>248</sup> *modulus* (Linné)**

Pl. 27, fig. 187

Alt., 12; diam. of base, 17 mm. Apex acute, spire of about three small whorls, depressed; body whorl large with sloping shoulder and definite peripheral keel; color yellowish white with brown markings, brownish epidermis; sculpture over upper portion of shell consists of low revolving ridges and 10 radiating ribs which terminate at peripheral keel; base has six or eight strong revolving ribs separated by deep grooves which are striate by growth lines; umbilicus small, deep; aperture round below, oblique to vertical axis,

<sup>247</sup> Gr., *meiosis*, to make smaller; *keras*, horn; Lat., *nitidum*, shining.

<sup>248</sup> Lat., *modulus*, a measure.

angled at keel of body whorl; outer lip thin, crenulate; columella with sharp horizontal basal tooth; operculum corneous.

**Modulus modulus floridanus** Conrad

Pl. 27, figs. 188a, b

Alt., 13; diam. of base, 14 mm. General characters of *M. modulus*; whorls more convex, peripheral keel less marked, about 15 radiating ribs; aperture round, oblique to vertical axis; columellar tooth slightly oblique, a little smaller and lower than in *M. modulus*.

Both *M. m. floridanus* and *M. modulus* are common on grassy bottoms in shallow, protected waters.

#### Family TRIPHORIDAE

Some hundred species are included in this family of small mollusks. Their distribution is general through warm and temperate seas. With members of the related family Cerithiopsidae, they have a considerable range in depth.

The shells are sinistral, slender, with many whorled, elongate spire and a somewhat contracted body whorl with small aperture and short recurved canal.

Genus **TRIPHORA** Deshayes, 1824

**Triphora perversa nigrocincta**<sup>249</sup> (C. B. Adams)

Pl. 27, fig. 189

Alt., 11 mm. Shell small, sinistral, cylindro-conic; apex acute; dark brown; faded shells pale brown with dark revolving band; from 12 to 15 whorls, not well defined; sutures slightly excavated; sculpture of three sometimes four roundly beaded spirals; with a lens, beads are seen to be light-colored, lower part of body whorl with strong revolving ridges; aperture oval, oblique, deep posterior notch; short, recurved anterior canal; outer lip thin, sharp, a little flaring; operculum corneous.

In fully adult shells both the anterior canal and posterior notch become completely tubular, and growth of the body whorl continues for about one-half turn beyond closing of canals. In juvenile shells the base of the body whorl is flat, the aperture simple; all stages of development of adult characters of aperture and canals may be seen

<sup>249</sup> Gr., *tri*, thrice; *phora*, from Gr. *phorein*, to bear, denoting a group which bears a special feature; Lat., *perversus*, turned the wrong way; *niger*, black; *cinctus*, encircled.

in a series of specimens.

From one to thirty fathoms.

#### Family CERITHIOPSIDAE

Shells of the Cerithiopsidae are small, cylindrical, many whorled with spiral sculpture and short anterior canal.

Distribution principally in northern and temperate seas at considerable depths.

Genus **CERITHIOPSIS** Forbes and Hanley, 1851

**Cerithiopsis**<sup>250</sup> **greeni** (C. B. Adams) Pl. 27, fig. 190

Alt., 4.5 mm. Shell small, cylindrical, swollen in the middle, apex acute; color dark reddish brown; 10 to 12 whorls; sutures excavated. Spiral sculpture of three rows of tubercles, so placed that an effect of longitudinal ribbing is produced; interspaces and sutures with fine striations. Aperture oval, outer lip sharp; short, oblique, anterior canal; operculum corneous.

Subgenus **LASKEYA** Iredale, 1918

**Cerithiopsis emersonii** (C. B. Adams) [*"C. subulata* (Montagu)"] Pl. 27, fig. 191

Alt., 10-14 mm. Shell small, brown cylindrical, apex acute; 10 to 15 flat whorls; sutures distinct, channeled; axial ribs cancelled by two strong grooves into nodulous spirals, three on whorls of spire, four on body whorl; general effect of sculpture spiral rather than longitudinal; base slightly concave with two prominent spiral ridges; aperture small, subquadrate, about one-sixth of shell, canal less than one-half of aperture, columella spirally twisted; operculum corneous.

From one to fifteen fathoms.

Lives commonly among sponges. Eggs in holes bitten in sponge in little nests, singly and well separated. Capsules 0.35 mm. across. Eggs about 0.03 mm. in diameter.—Marie Lebour.

Genus **SEILA** A. Adams, 1861

**Seila**<sup>252</sup> **adamsii** (H. C. Lea) Pl. 27, fig. 192

Alt., 10 mm. Shell brown, elongate cylindrical, apex acute; 10

<sup>250</sup> Gr., *keration*, little horn—irregular form; *opsis*, appearance.

<sup>251</sup> Lat., *subula*, an awl.

<sup>252</sup> Gr., *scira*, cord, string.

to 14, flat whorls regularly increasing in size; sutures distinct, excavated; sculpture of three equal-sized spiral ridges, flattened on top; concave interspaces with fine spiral striations above ridges and delicate axial striations which do not cross ridges. Body whorl has four spirals, one smaller ridge at circumference of base. Aperture oval; outer lip crenulated with external sculpture; anterior canal central, short, open, recurved; operculum corneous.

Common in shallow water. Often found about oyster bars, within large dead shells.

#### Family CERITHIIDAE

The Cerithiidae are mollusks of tropical and semitropical seas. Many of the species are littoral, living among sea grasses and weeds; others frequent rocky bottoms in deeper water.

The animals are vegetarian and the sexes are separate. A pedal gland secretes threads of mucus by means of which the mollusks can attach themselves to any convenient object, or hang suspended beneath the surface film of water.

Shells of the Cerithiidae vary in form within certain limits; all are elongate, many whorled, with a small oblique aperture and a short anterior canal.

#### Genus CERITHIUM Bruguière, 1789

*Cerithium algicola*<sup>253</sup> C. B. Adams

Pl. 27, fig. 193

Alt., 20-27 mm. Shell white with brown markings usually disposed in more or less revolving pattern. Spire elongate, tapering to acute apex; eight to ten convex whorls, angulated by axial ribs; sutures narrow, incised. Sculpture of eight or ten indefinite longitudinal ribs or varices, interrupted at sutures and angulated at periphery of whorls; a nodular spiral line immediately below suture on body and penultimate whorls; three headed spirals below periphery of body whorl, fine spiral threads between the stronger sculpture; a thickened varix opposite aperture; aperture oval, oblique, outer lip thin, crenulate; anterior canal short, oblique; columella with transverse fold above, which defines a short posterior channel;

<sup>253</sup> Gr., *keration*, little horn—N. L., *algicola*, living on seaweed.

base with spiral cords; operculum corneous, light brown.

From below tide mark to one and one-half fathoms.

***Cerithium floridanum* Mörch**

Pl. 27, fig. 194

Alt., 30-35 mm. Shell white with spirally striate pattern of brown; thin epidermis; spire elongate, apex acute; sutures not well defined; 10 or 12 whorls crossed by elevated, interrupted nodular ribs, sharply angled at periphery of whorls; unequal spiral ridges separated by incised lines over entire external surface of shell; a thickened varix opposite aperture; aperture oval, oblique; outer lip thickened, crenulated by spiral sculpture; anterior canal short, oblique; posterior canal defined by fold at upper part of columella.

*C. floridanum* is often confused with *C. algicola*. The former is more slender, with more elongate spire, fewer ribs, about 11 on penultimate whorl—*C. algicola* has about 16. Sculptural features stronger and more distantly spaced; outer lip thickened.

From extreme low tide mark to five fathoms.

***Cerithium muscarum*<sup>254</sup> Say**

Pl. 27, fig. 198

Alt., 25 mm. Shell white with fly-specks of chestnut-brown or almost uniformly brown; apex acute; sutures incised, undulating; 10 convex whorls crossed by 10 or 11 axial ribs, interrupted at sutures, slightly nodulated by spiral ridges; a strong varix opposite aperture; spiral sculpture of equidistant elevated ridges and fine interspatial striations over whorls and base; base defined by a strong cord; aperture typical, basal canal reflected to left.

Abundant on grassy bottoms in shallow water.

***Cerithium variabile* C. B. Adams**

Pl. 27, fig. 195

Alt., 12 mm. Shell dark brown or grayish white; apex and first few turns often white; apex acute; about eight slightly convex whorls; sutures distinct, a little excavated; sculpture of seven or eight beaded spirals on body whorl, three rows on whorls of spire; fine revolving striations in interspaces; a strong varix on body whorl opposite aperture; aperture oval, outer lip sharp at edge, thick and crenulate within; interior of aperture white; anterior canal short, posterior angle of aperture scarcely sinuate; operculum typical.

<sup>254</sup> Lat., *musca*, a fly.



The animal has a white foot, body mottled black and white, black eyes surrounded by white circles and placed a little behind bases of the tentacles.

Shallow water beyond low tide mark. Often about oyster bars.

Genus **BATILLARIA** Benson, 1842

**Batillaria minima**<sup>255</sup> (Gmelin)

Pl. 27, fig. 196

Alt., 13 mm. Shell rather stout and rotund, black, ashen or bluish gray, sometimes ferruginous—often with dark or light sutural bands; six to eight whorls sculptured with low longitudinal ribs unequally nodulated by spiral ridges; fine spiral threads in interspaces; aperture oval, lip sharp; anterior of aperture dark-colored; basal canal sharply deflected to left.

*B. minima nigrescens* (Menke) is the specific name given to the black, unicolored type.

Common and abundant between tide marks.

**Batillaria minima septemstriata**<sup>256</sup> (Say)

Pl. 27, fig. 197

Alt., 12 or 13 mm. Shell a little more slender with *B. minima*, similar in general characters; dark-colored with white sutural band; longitudinal ribs nodulated by elevated spirals; longitudinal ribs sometimes bifid over base of body whorl.

Found with *B. minima*.

Genus **CERITHIDEA** Swainson, 1840

**Cerithidea costata**<sup>257</sup> (da Costa)

Pl. 28, fig. 199

Alt., 12-15 mm. Shell brown, darker band below sutures; spire turreted, apex acute; nine or ten convex whorls; sutures distinct, marked by spiral threads; about 15 curved, longitudinal ribs over each whorl, not continuous across sutures; aperture oval, notched or channeled at base.

Shallow, brackish water. Tidal salt flats.

**Cerithidea costata turrita**<sup>258</sup> Stearns

Pl. 28, fig. 201

Alt., 10-12 mm. Shell pale fawn color with lighter band about periphery of whorls, periostracum rather thick; spire turreted, apex

<sup>255</sup> Lat., *minimus*, the least.

<sup>256</sup> Lat., *septem*, seven; *striatus*, striped.

<sup>257</sup> Lat., *costatus*, from *costa*, rib.

<sup>258</sup> Lat., *turris*, tower.

acute; about 10 convex whorls with numerous longitudinal ribs terminated at base of body whorl by a single spiral thread; aperture oval; anterior canal shallow.

Tidal flats and near low water mark.

*Cerithidea scalariformis*<sup>259</sup> Say

Pl. 28, fig. 200

Alt., 20-25 mm. Color light fawn, spirally banded with brown, occasionally with white; spire tapering, apex usually truncated; sutures well impressed, defined by narrow threads; 10 convex whorls crossed by numerous, closely placed, slightly curved ribs; on body whorl ribs terminate at periphery; spiral sculpture of whorls indistinct; aperture rounded, lip thickened, reflected, with flattened margin; columella straight; position of anterior canal indicated by a shallow notch; base with strong spiral cords.

Common on tidal salt flats.

Genus **BITTIUM** Leach in Gray, 1847

*Bittium varium*<sup>260</sup> (Pfeiffer)

Pl. 28, fig. 202

Alt., 5-6 mm. Shell thin, grayish white or buff-colored; apex acute, spire tapering; seven or eight flattened convex whorls; sutures well defined; sculpture of delicate, slightly curved longitudinal ribs nodulated by fine spiral grooves; aperture oval, lip not thickened, a well-developed varix posterior to lip; anterior canal not defined; base spirally grooved.

Common in shallow water on grassy bottoms.

*B. varium gibberulum* Adams is dark brown with smaller body whorl varicosely gibbous, and sculpture more sharply cut than in the typical *B. varium*.

Meyer and Moebius have described spawn as a flat, slimy, spiral coil, about 3 mm. across. Lo Bianco describes it as a white ribbon, irregularly folded upon itself.—Marie Lebour.

Look for this on eel grass.

#### Family **STROMBIDAE**

The Strombidae constitute an interesting family of about 100 species distributed through warm seas, usually in shallow water. Almost no other group of mollusks rivals it in the variety of form

<sup>259</sup> Lat., *scala*, ladder, staircase.

<sup>260</sup> Lat., of obscure origin; *varius*, diverse.

and beauty of color of its shells. It is represented in American waters by the single genus *Strombus*.

The animals live between low tide mark and 10 fathoms on sandy or gravelly bottom, where their carrion food can be found in abundance. "Strombs" are scavengers and are equipped with acute senses of sight and smell and exceedingly strong jaws and teeth. The sexes are separate.

The foot of *Strombus* is long, narrow and strong, bearing a terminal, clawlike operculum, too small to close the aperture of the shell, but making of the foot an efficient prop on which the creature can raise itself, and by awkward, jerking movements fall to one side or forward. This ungainly mode of progression enables *Strombus* to move about, and stranded individuals seem to make some effort to regain the water.

Shells of the Strombidae are large, thick and solid, with short, conical spire, acute apex and large body whorl with a long, narrow aperture which is notched or canaliculate both anteriorly and posteriorly. The outer lip is thick, expanded or alate, and in some genera its outer margin is deeply indented like the spread fingers of a hand. Living shells have a brownish periostracum which quickly scales off with exposure and drying. The color of the shells is usually a combination of pale shades of brown and buff, and the polished inner surface of the lip shows beautiful blending of pale pink, orange, purple, and sometimes a greenish tinge.

Genus **STROMBUS** Linné, 1758

***Strombus pugilis alatus***<sup>261</sup> Gmelin

Pl. 28, figs. 203, 204

Alt., 80 mm. Shell pyriform, solid and heavy; color ranges through shades of ivory and brown, often disposed in banded or zigzag patterns; brownish periostracum; spire of eight whorls, eight-tenths altitude of shell; body whorl large, smooth, narrowed toward base where it is spirally striate; early whorls with strong revolving ribs and longitudinal ribs which become prominent, spinous tubercles about shoulders of later whorls; sutures distinct, lower whorl appears to slightly overlap preceding whorl; aperture straight, narrow; lip thickened, alate, protracted above with deep notch at

<sup>261</sup> Gr., *strombos*, a spiral shell so named by Aristotle; Lat., *pugil*, a boxer; *alatus*, winged. -

suture; a rounded notch near base and a deep recurved, basal notch; interior polished, beautifully colored in shades of orange, salmon-pink, purple and brown; columellar callus polished, reflected over front of body whorl.

*Strombus pugilis alatus* Gmelin is the most common large gastropod on the sand bars and tidal flats about Sanibel Island, Florida. Normal depth range in this locality seems to be from low tide mark to two or three fathoms. Dredging operations off Sanibel Island in depths greater than three fathoms yield only an occasional individual *Strombus* during the fall and winter, but in March of 1938 and 1939, great numbers of *S. pugilis alatus* were taken in five to seven fathoms of water, six to ten miles off shore. For half a dozen hauls, the dredge came in filled with these mollusks alone. Prodigious numbers must have assembled in restricted localities where conditions were congenial to them, as the experience was repeated at various places over a considerable area. All were taken on sandy and gravelly bottom in company with sea urchins, sand dollars, and but few other mollusks.

Most of the *Strombus* were adult, and from the posterior notch tangled masses of thin cordlike threads, covered with adherent grains of sand and small bits of broken shell hung, seemingly attached to the mollusk. These threads were extruded through the posterior sinus in masses equal to a tablespoonful. The animals were all withdrawn into the shells when captured, but in each observed case, the egg mass was attached to the mollusk and required some force for withdrawal. Some of the shells were infested with the boring sponge, *Cliona*, but the infestation must have been recent as the borings were scattered and superficial.

Occasional specimens of fresh juvenile and adult shells of *Strombus costatus inermis* are found on the Gulf beaches of Captiva and Sanibel Islands, also infrequent worn specimens of *Strombus gigas*.

#### Family OVULIDAE

The mollusks of this family resemble and are closely akin to the animals of the Cypraeidae.

The shells are ovoid or fusiform, with a straight linear opening, canalculated at each extremity of the shell.

Distribution is in warm and temperate seas. The animals prey upon gorgonians to whose stems and branches they adhere very closely.

Genus **CYPHOMA** Röding 1798

**Cyphoma megintyi**<sup>262</sup> Pilsbry

Pl. 48, figs. 333a, b

Length, 23.7; width, 11.4 mm. The shell is long and narrow, with a high median ridge; back cinnamon-buff to ivory-yellow, the marginal callus white or ivory yellow, more definitely limited than in *C. gibbosa*, with an oblique fold from the inner lip across the front posteriorly, more or less lost in the callous thickening; interior vinaceous with a white median spot; mantle closely spotted.<sup>263</sup>

These shells are usually found on *Gorgonia*. They have been taken on the reefs off Sanibel Island.

Genus **SIMNIA** (Leach) Risso, 1826

**Simnia uniplicata**<sup>264</sup> (Sowerby)

Pl. 28, fig. 205

Alt., 15-20 mm. Shell tapering at each extremity, smooth, polished; color varies with that of the *Gorgonia* upon which it preys—yellow or a shade of purplish red; color fades with drying and exposure to light; apex of shell twisted backward over nucleus and extended into a short canal. Lip thickened in adult specimens; one columellar fold near apex.

#### Family CYPRAEIDAE

The mollusks of this family are remarkable for the beauty of color, high polish and the symmetry of form of their shells. Cowries are everywhere considered elegant shells. Specimens of the genus *Cypraea* are eagerly desired by collectors, and the shells of certain tropical species still serve as units of monetary currency in some parts of the world.

All species are native to warm seas.

Worn shells of *Cypraea exanthema* and *C. exanthema cervus* are occasionally found upon the beaches of southwest Florida.

<sup>262</sup> Gr., *cyphoma*, a hump, hump-backed; named for Thomas L. McGinty.

<sup>263</sup> The Nautilus, vol. 52 (3), page 108.

<sup>264</sup> Lat., *uni*, *unus*, one; *plicatus*, folded.

Genus **TRIVIA** Gray, 1837**Trivia pediculus**<sup>265</sup> (Linné)

Pl. 28, fig. 206

Alt., 12-15 mm. Shell subglobular with longitudinal dorsal groove and fine transverse ribbing; extremities obtusely rounded; aperture linear, canaliculate at extremities, transverse ribs continuous over involved lips; flesh-colored with spots and mottlings of brown.

Animal is grayish, mantle with pin-dots of red, foot gray, eyes at outer base of tentacles.

Taken on grassy bottoms near passes in Pine Island Sound, Lee County, Florida. Dredged in the Gulf of Mexico in three to seven fathoms.

**Trivia malthiana**<sup>266</sup> Schwengel and McGinty

Pl. 49, fig. 335

Length, 13; breadth, 10; height, 8 mm. This *Trivia* is about the same size and shape as *Trivia pediculus* but is a creamy pink with a large pale pink blotch in the center of the back. The ribs are smoother and faintly continuous across the shallow dorsal sulcus.

Dredged in 14 fathoms off Destin, Florida.

Genus **ERATO** Risso, 1826**Erato mangeriae**<sup>267</sup> Gray

Pl. 28, figs. 207a, b

Alt., 6 mm. Shell small, polished, greenish gray or olive-green, white about lip margin; shape much like *Marginella*; spire inconspicuous, depressed; body whorl large, rounded, narrowed toward base; aperture elongate, outer lip thick, lirate within; a basal notch but no posterior notch.

The animal is definitely phototrophic in aquarium and is able to creep beneath surface film. Body mottled brownish, mantle grayish with metallic-red spots, similar to mantle of some *Marginellas*.

Dredged in two to seven fathoms. Generally found among rugosities of zoöid colonies or clinging to valves of *Atrina*.

Family **CASSIDIDAE**

Distribution of members of this family is general in warm seas and through shallow to moderate depths. Sandy stations are pre-

<sup>265</sup> Lat., *trivialis*, *tri*, three; *via*, way; *pediculus*, louse.

<sup>266</sup> Named for B. L. Maltby.

<sup>267</sup> Gr., *Erato*, muse of poetry.

ferred by all species of the Cassididae, where many bivalves fall victim to their predatory habits and voracious appetites.

The animals possess eyes, formidable jaws, a radula and a voluminous foot which participates in the secretion of the shell.

Typical shell is ventricose and solid, with a large inflated body whorl and a short, but well-elevated spire. The aperture extends the length of the body whorl and is prolonged into a short, sinistrally curved canal. The outer lip is thick, often reflected, and usually dentate within. The columella is plicate or granulose.

Genus **PHALIUM**<sup>268</sup> Link, 1807

Subgenus **SEMICASSIS** Mörch, 1852

**Phalium granulatum**<sup>269</sup> (Born) (*S. gibbus* Gmelin)

Pl. 29, fig. 208

Oval shell with rather acuminate spire, shell pink to nearly white, with six series of squarish cinnamon spots, those at suture and extreme base often smaller, irregular or weak. Deeply grooved spirally, the moderately convex or sometimes nearly flat raised cords being much wider than the grooves, seventeen to nineteen on last whorl, second from suture generally narrow. Upper four or five cords generally crossed by narrow tubercles, these may be weak or practically absent. A few have a varix preceding that at the lip by about a whorl, more or less. Large specimens from 75 to 80 millimeters long.<sup>270</sup>

Operculum pale brown, semilunar with plications radiating from nucleus near inner border to the finely dentate outer border.

One fresh juvenile shell of *Cassis madagascarensis* has been dredged in four fathoms off Sanibel Island.

Family **TONNIDAE**<sup>271</sup>

A family of mollusks with close affinities to the Cassididae, also distributed in warm seas and preferring sandy bottoms.

The animals are notable for the extreme length of the siphon, the large foot, and the reputed ability to secrete sulphuric acid.

Genus **FICUS** Röding, 1798

**Ficus communis**<sup>272</sup> Röding (*F. papyratia* Say)

Pl. 29, fig. 209

Alt., 90 mm. Shell thin, translucent, pear-shaped, brownish or bluish gray; thin periostracum, spire short, depressed, top of shell

<sup>268</sup> Gr., *phalios*, for *phalaros*, with white patches.

<sup>269</sup> Lat., *cassis*, helmet; *granulatum*, granulated; *gibbus*, a hump.

<sup>270</sup> Pilsbry, H. A., and McGinty, T. L.: Nautilus, vol. 52, No. 3. Condensed description.

<sup>271</sup> Lat., *tonna*, a cask.

<sup>272</sup> Lat., *communis*, common; *ficus*, fig; *papyraceous*, made of paper.

flattened; body whorl expanded above, narrowed into a moderately long, straight anterior canal; sutures linear, slightly depressed; sculpture of revolving cordlike ribs, wide interspaces with an almost centrally placed narrower rib and fine laterally placed threads; entire surface closely cancellated by fine growth lines; aperture well open, length and width of body whorl; outer lip sharp; columella concave at center; interior polished, golden-brown; no operculum.

Common on beaches after blows. From one to four fathoms.

Egg capsules of *Ficus communis* Röding

Pl. 49, figs. 337a, b, c,

*Ficus communis* arranges columns of egg capsules somewhat in organ-pipe fashion. About 10 or 15 flat oval capsules with gently fluted edges, 25 mm. in diameter, are evenly attached one above another to some dead shells. These columns are attached one to another, sometimes 8 or 10 in one group. The capsules resemble those of *Busycon "contrarium"* in shape, but are small, thin and delicate in texture and easily detached from each other. One short column may contain empty capsules at the distal end with embryos in progressive stages of development in adjacent capsules. From the numerous small ova in each capsule only 4 to 20 embryo reach maturity. Egg capsules of *Ficus* are seldom found earlier than March.

Rarely, worn specimens of *Tonna galea* are washed upon the beaches of Sanibel Island.

#### Family CYMATHIDAE

This family comprises the triton shells, one of which was the "wreathed horn" of the ancient sea god, son of Poseidon and Amphitrite, the horn which he blew upon to calm the waves.

The animals of the family are brightly colored and possess a gland which secretes colored fluid of brilliant tint, in some instances a green color and in others a fine blue.<sup>273</sup>

The mollusks are native to warm and temperate seas.

Genus CYMATIUM Röding, 1798

Subgenus MONOPLEX Perry, 1811

*Cymatium costatum*<sup>274</sup> (Born)

Pl. 29, fig. 210

Alt., up to 150 mm., shoulder of body whorl almost median;

<sup>273</sup> Fischer, P.: Manual of Conchology, vol. II, p. 20.

<sup>274</sup> Gr., *kymatian*, dim. of *kyma*, wave; Lat., *costatus*, ribbed.



shell solid; about seven convex whorls, rapidly increasing in size from acute apex; taffy color; clear brown epidermis with longitudinal reflections whose edges bear numerous hairlike processes; sculpture of strong revolving ribs, equally wide interspaces and incised lines; ribs somewhat nodular over upper whorls. Sutures distinct; aperture oval, prolonged into straight, open, anterior canal; outer lip thickened, margin scalloped by external ribs, slightly reflected inward, convexity of scallops brown; columella sinuous, finely plicate, brown between plaits. Interior polished, ribbed; operculum corneous, brown.

The animal is greenish mustard-yellow and black-spotted.

Several living specimens have been found on Sanibel beach after storms.

A few worn shells of *C. aquitilis*, *C. cyanocephalum* and *C. femorale* have been found on western Florida beaches, but a local origin is improbable.

#### Order **STENOGLOSSA**<sup>275</sup>

##### Family **MURICIDAE**

The family Muricidae has adapted itself to as wide and diverse a range of habitat and distribution as any member of its phylum. Every sea has genera peculiar to its depth and temperature, but the great majority of the thousand odd species are found in tropical or subtropical waters.

The cannibalistic Muricidae prefer to live on gravelly bottom, about coral or rocky reefs where an abundance of other mollusks provides a sufficiency of food to satisfy their carnivorous appetites, both pelecypods and gasteropods being acceptable victims. *Murex*, *Eupleura*, and *Urosalpinx* are enemies to the oyster; *Arca* is a favorite food of *Murex*, which attacks it by thrusting the tough proboscis between the ark's open valves in such a manner as to prevent closure while the animal is being eaten alive. Aristotle wrote of *Murex* that the mouth is armed with a sort of trunk comparable to those of the fly or rather those of the gadfly.

B. B. Woodward wrote that those Murices which have spines about the aperture have one spine directed inward which is used

<sup>275</sup> Gr., *stenos*, narrow; *glossa*, tongue.

as a knife. Bivalve prey is gripped by the powerful foot and the shell margin pressed against the spine until it is driven like a wedge between the two valves, forcing them apart.

The Muricidae possess a special glandular structure whose secretion affords a royal shade of purple when appropriately treated. This property of the Muricidae was known to early races of the Mediterranean people, who made from certain of these mollusks the Tyrian purple dye.

The shells of this group of mollusks are thick and solid, with moderate spires terminating in sharp apices. The body whorls are relatively large and the round, or rounded apertures are produced into straight, partly closed canals or notches; no posterior cord or notch is present. The shell surface is rough, and usually bears longitudinal rows of more or less tuberculate or spiny protuberances, useful as protection against fish and other predatory enemies.

Genus **MUREX** Linné, 1758

**Murex**<sup>276</sup> *cabritii* Bernardi

Pl. 30, fig. 211

Alt., 50-55 mm. Smooth, thin periostracum. Unicolor, flesh or deeper pink; spire of four and a half convex whorls, nucleus minute; body whorl rounded; aperture prolonged into straight, partly closed anterior canal more than half the height of shell; sculpture of three equidistant strong axial ribs bearing sharp spinous processes; between these ribs are low rounded ribs; revolving channels render ribs slightly nodulous; sutures distinct; aperture oval, outer lip crenulate; columellar callus continuous with canal wall; two rows of sharp spines, usually six, on canal; operculum light brown, corneous. The delicate spinous processes may be partially developed or absent. In beach specimens they are usually broken. Beautiful and perfect specimens are taken by the divers of the Tarpon Springs sponge fleet. Fresh shells have been found on Sanibel beaches and living specimens dredged off Marco, and Destin, Florida.

Depth range 25 to 164 fathoms.

**Murex recurvirostris rubidus**<sup>277</sup> F. C. Baker

Pl. 30, fig. 212

Alt., 30 mm. to 50 mm. General characters of shell similar to those of *M. cabritii*; spire acute and slightly more extended;

<sup>276</sup> Lat., *murex*, the purple shellfish.

<sup>277</sup> Lat., *recurvirostris*, curved beak; *rubidus*, red.

smaller; spines short or absent, often curved; usually three spines on upper part of canal or columellar side; anterior canal extended, more or less than half the height of shell, curved backward, almost closed at base of aperture; color variable; cream, pink, brownish-pink, pale orange, salmon and red; often brown-banded; hispid epidermis; operculum light amber color.

Subgenus **CHICOREUS** Montfort, 1810

**Murex florifer arenarius**<sup>278</sup> Clench and Parfante ("M. rufus Lam.")

Pl. 30, fig. 213

Alt., up to 70 mm. Shell with general characters of the group; young, shell-pink or orange, remaining as colored apex in adult; ground color ivory, spiral pencilling of brown; about seven convex whorls, sutures distinct; sculpture of low, rounded, interrupted ribs and strong, equidistant spiral cords expanded into three varices of delicate acanthus-leaf processes, continued almost to base of canal; interspaces with revolving threads; columellar collar about inner lip of oval aperture; canal curved backward, almost closed, expanded and flattened below.

Dredged in three to seven fathoms. Not uncommon on beaches. Occasional specimens in inside waters.

Subgenus **PHYLLONOTUS** Swainson, 1833

**Murex pomum**<sup>279</sup> Gmelin

Pl. 30, fig. 214

Alt., up to 80 mm. Shell thick, rough; ivory color with mottlings and revolving stripes of brown; light epidermis; spire about three-tenths of altitude; body whorl large, sutures distinct; three prominent, equidistant varices; others less well developed; revolving sculpture of strong cords and fine threads, cords expanded into lamellae or short spires over the prominent varices; aperture large, rounded, an internal sulcus parallel to outer lip; interior smooth, tinted with purple, brown and pink; outer lip crenulate; columellar callus reflected over body whorl, upstanding columellar collar; canal short, deep, almost or quite closed; flattened, curved backward from aperture; operculum brown.

Three to seven fathoms. Not uncommon on beaches.

Egg capsules of **Murex pomum** Gmelin

Pl. 49, figs. 33Sa, b, c

<sup>278</sup> Lat., *florifer*, bearing flowers; *arenarius*, sandy.

<sup>279</sup> Lat., *pomum*, apple.

Genus *EUPLEURA* H. and A. Adams, 1853*Eupleura caudata sulcidentata*<sup>280</sup> Dall

Pl. 31, fig. 215

Alt., 25 mm. Shell with acute apex; spire of five or six whorls, about one-third height of shell; color white, brown, frequently in banded pattern, varices usually white; body whorl not proportionately large; whorls acutely keeled; sutures distinct; sculpture of plicate lamellar varices, one at outer lip and one immediately opposite on body whorl give a flattened appearance to shell. Aperture small, oval, prolonged into a straight, nearly closed, tapering canal, slightly recurved backward; outer lip thickened by plicate lamellar varix. Operculum corneous, clear amber color with two broad bands of dark amber radiating from center of outer margin.

From littoral zone to six fathoms.

The animal is white with opaque mottlings, pin-point black eyes placed on tentacles three-fourths of the distance from base.

Egg capsules of *Eupleura caudata sulcidentata* Dall

Pl. 49, fig. 339

*Eupleura caudata sulcidentata* deposits most delicate and graceful little capsules, well shown in the drawing. Their height is about 5 mm. They are deposited singly in rows or groups of three to eight or ten, on dead shells below low tide mark. One individual in the laboratory deposited five capsules during one night and none thereafter. Embryos matured in fourteen days in three capsules. Ova in the remaining two egg capsules failed to develop. There are five to ten ova in each capsule. *Eupleura* spawns from February to late Spring.

*Eupleura nitida*<sup>281</sup> (Broderip)

Pl. 31, fig. 216

Alt., 17.5 mm. Color chocolate-brown with a few revolving white bands, varices white; spire of five whorls, apex acute, apical whorls loosely coiled, body whorl not relatively large; whorls sharply shouldered; sutures distinct; longitudinal sculpture of low, round ribs and two lamellar varices on body whorl; last two whorls of

<sup>280</sup> Gr., *eu*, well; *pleura*, rib; Lat., *cauda*, tail; *sulcus*, furrow; *dentatus*, toothed.

<sup>281</sup> Lat., *nitidus*, shining.

spire with two spiral cords at periphery, upper cord at shoulder of whorl; four spiral cords on body whorl, four below in more oblique spiral; revolving sculpture overlays longitudinal ribs; on body whorl cords expand into plicate lamellar varices at outer aperture and on columellar sides of whorls; rudimentary development of varices on penultimate whorl; aperture small, oval, interior white-banded dark brown; outer lip bordered by expanded white varix; five small tubercles at base of varix; operculum brown.

One living specimen dredged in six fathoms off Redfish Pass, Lee County, Florida.

Subgenus **FAVARTIA** Jousseaume, 1880

**Murex cellulosus**<sup>282</sup> Conrad

Pl. 31, fig. 217

Alt., up to 22 mm. White, sometimes brown about ribs, thick epidermis; spire sharp, five whorls, about one-third of entire height; body whorl fairly large, sutures well defined; prominent, angular axial ribs, five on body whorl; two strong revolving ribs on each whorl of spire; six on body whorl, interspaces cancellated by longitudinal threads; revolving sculpture overlaps longitudinal ribs; aperture oval, prolonged into short backward curving nearly closed canal, interior purplish; outer lip thin, crenulate; heavy varix immediately interior. Each varix on body whorl terminates in a former recurved canal, in fully adult and perfect shells four canals of an earlier period of growth are evident at base of shell; operculum brown.

Dredged in two to six fathoms. Occasional specimens in inside waters.

Genus **MURICOPSIS** Bucquoy, Dautzenberg and Dollfus, 1882

**Muricopsis ostrearum**<sup>283</sup> (Conrad)

Pl. 31, fig. 218

Alt., up to 30 mm. Shell purplish, light sutural band, edges of revolving cords white; brownish epidermis; spire of five increasingly larger, well-shouldered whorls; body whorl not disproportionately large, sutures distinct; six to nine axial ribs; whorls of spire with two spiral cords, one at shoulder, nodulous at crossing of varices, one below, equidistant between shoulder and suture; body whorl

<sup>282</sup> Lat., *cellula*, a little cell.

<sup>283</sup> Lat., *murex*, the purple shellfish; Ops, Goddess of abundance; *ostrearum*, of oysters.

with about 10 spirals distributed to base of canal; whorls angulated by peripheral spiral, smooth above to suture; aperture oval, purple within; outer lip thin, columellar lip callus, crenate, lirate within; anterior canal short, straight, open. A notch at columellar side of canal indicates site of previous canal aperture. Operculum corneous, brown, fusoid with apical nucleus.

Two types of this shell are observed. The less common form is taken in one to six fathoms and differs from descriptions in the following respects. The shell is white without and within; a little longer and heavier than the dark form; incremental lines stronger; body whorl with six strong revolving ribs, between the pairs of first and second, and fifth and sixth strong spirals is a smaller cord; less strong spirals to base of canal; whorls above periphery are ribbed with five spirals. The operculum is blond—pale-straw color. Animal cream color.

Genus **UROSALPINX** Stimpson, 1865

**Urosalpinx**<sup>284</sup> **perrugata**<sup>285</sup> (Conrad)

Pl. 31, fig. 220

Alt., to 25 mm. Shell somewhat fusiform, white or cinereous, dark-colored between varices which are often touched with yellow. Six slightly keeled whorls and large smooth nucleus; body whorl moderate size, sutures distinct; longitudinally ribbed; spirally striate; sculpture strongest below periphery of whorls; aperture oval, dark-colored within, outer lip thin, crenate; canal short, straight, open, slightly curved backward; operculum yellow, nucleus at outer border.

Two to six fathoms.

Egg capsules of **Urosalpinx perrugata** (Conrad)

Pl. 50, fig. 341

The capsules of *U. perrugata* and *Cantharus floridanus* are so similar as to cause confusion. The three to five mm. purse-shaped cases are laid in overlapping rows of irregular groups upon other egg capsules, those of *Busycon* and *Fasciolaria* most frequently. There is evidence that *Urosalpinx* penetrates the egg capsules of the host and devours the contents. From three to eight embryos develop in each capsule.

<sup>284</sup> Uro, combining form from Gr., *oura*, tail; *salpinx*, trumpet.

<sup>285</sup> F., *perrugue*, from Pr. *perucat*, with dressed hair.

***Urosalpinx tampaensis* Conrad**

Pl. 31, fig. 221

Alt. to 25 mm. Shell brownish or cinereous, general features of *U. perrugata*; spire of four whorls below nucleus; about 10 longitudinal ribs, strong overlying spiral cords on body whorl below periphery, two on whorls of spire; shoulder of whorls without spirals, sculpture is well elevated with excavated spaces between axial ribs and revolving cords; outer lip deeply crenate.

Littoral region to about one fathom.

Genus **THAIS** Röding, 1798

Subgenus **STRAMONITA** Schumacher, 1817

***Thais haemastoma*<sup>286</sup> *floridana* (Conrad)**

Pl. 50, fig. 343

Alt., 46 mm.; diam., 24 mm. Shell solid, elongate, greyish white with brown markings; six or seven moderately rounded whorls, spirally sculptured with fine white lines, sixth or seventh line being wider; shoulder of whorls smooth or slightly angled, with or without two rows of small tubercles; suture faint and irregular; aperture about half the length of shell, nearly oval; outer lip crenulated, with brown lines extending into the opening, inner lip heavily callused and glazed; umbilicus almost closed; anal canal short and definite, margined with a heavy ridge; operculum corneous, dark brown.

*Thais* are carnivorous, feeding upon chitons and mussels. They often attack oyster beds and become a menace. The adult exudes a milky froth when disturbed which quickly turns to a deep purple and was used by the ancients to dye the cloth for royal robes. Aside from the dyeing qualities of this substance, it is poisonous and serves to immobilize the victim for the next meal.

Family **COLUBRARIIDAE**

The mollusks of this family were formerly included among the Tritonidae. Distribution of its genera is through temperate and warm seas.

The shells are fusiform, spire elongate, long oval aperture, with a short recurved canal.

<sup>286</sup> Lat., *Thais*, wife of Ptolemaerus I of Egypt; *hacma*, blood; *stoma*, mouth.

Genus **COLUBRARIA** Schumacher, 1817**Colubraria lanceolata**<sup>287</sup> (Menke)

Pl. 31, fig. 222

Alt., 27 mm. Shell slender, yellowish white, maculated with brown; thin epidermis; six low-convex whorls tapering to sharp apex, nuclear whorls dark brown; body whorl more than half the height of shell, sutures distinct; cancellate sculpture of fine longitudinal ribbing and elevated spiral threads; each whorl crossed by one or two strong varices; aperture long-oval, outer lip thickened by a strong varix; columella arcuate, callus elevated into a collar; short, recurved canal; operculum corneous, fits aperture.

Dredged from rocky and gravelly bottom in three to five fathoms.

Family **COLUMBELLIDAE**

The members of this family are distributed through warm and temperate seas, comparatively few are adapted to cold waters. Their range in depth is from the littoral zone to some 650 fathoms. These beautiful small shells are many in species and individuals.

The shells are small, often smooth, without striking pattern of color or sculpture, generally ovate or fusiform, with narrow aperture and a short anterior canal. The columellar lip has a tubercle at its lower part and the outer lip is usually thickened and crenulated within. The operculum is corneous, nucleus at base or near middle of outer margin.

Genus **PYRENE**<sup>288</sup> Röding, 1798Subgenus **MITRELLA** Risso, 1826**Pyrene albella iontha**<sup>289</sup> (Ravenel)

Pl. 32, fig. 227

Alt. to 10 mm. Shell uniformly light or amber, light forms often flecked or pencilled with chestnut; dull brownish epidermis; seven or eight whorls, spire elongate, acuminate, whorls flattened, sutures distinct; 15 to 16 well-elevated axial ribs, extending to periphery of body whorl; faint or no spiral striations in intercostal spaces; base of body whorl smooth, strong spirals below, revolving about canal; aperture oval; short, slightly oblique anterior canal; other characters typical; shell more slender, spire more elongate and acuminate than *A. avara similis* with which species it is easily

<sup>287</sup> Lat., *colubrinus*, pertaining to a serpent; *lanccola*, little lance.

<sup>288</sup> Gr., *pyren*, stone of a fruit; Lat., *mitra*, a liturgical headdress.

<sup>289</sup> Lat., *albus*, white; *ella*, dim. suffix; *iontha*, hairy.



confused. The uppermost denticle of the outer lip in *P. a. iontha* is definitely larger and more prominent than its fellows.

Abundant in shallow water among weeds and grasses.

Egg capsules of *Pyrene albella iontha* Ravenel Pl. 50, fig. 344

*Pyrene Innata*<sup>290</sup> (Say) Pl. 32, fig. 228

Alt., 6 mm. Shell smooth, polished, light-colored or amber with crescentic markings of chestnut below sutures; sutures shallow, whorls of little convexity; no sculpture save spiral striations at base; other characters typical.

*P. lunata duclosiana* d'Orbigny is a southern form of this species. It is dark reddish brown or yellowish, with one or more series of sublunate markings on body whorl.

Common and abundant on weedy bottoms of littoral zone.

Genus *ANACHIS* H. and A. Adams. 1853

*Anachis avara semiplicata*<sup>291</sup> (Stearns) Pl. 31, fig. 224

Alt. to 16 mm. Shell slender, fusiform; greenish or grayish, finely reticulated with chestnut; thin epidermis; about eight low-convex whorls; spire acuminate; 12 ribs on upper part of body whorl, spiral striations over lower portion; traces of ribs on penultimate whorl; sutures distinct; aperture length of body whorl; narrow, short, straight canal; outer lip thickened, thin at extreme edge, denticulate within; columella curved above, no notch, columellar callus polished; operculum small, oval.

Abundant in shallow water among grasses and weeds.

Egg capsules of *Anachis avara semiplicata* (Stearns) Pl. 51, fig. 345

Ova deposited in sheets—30 to 100 individual capsules. Free margins slightly overlapping and placed in no regular order. Individual capsules approximately 1.5-2 mm. by .5 mm. in height at the center; slightly oval, slightly elevated and rounded at the top; thin, free, delicately creased margin about each capsule, often slightly overlapping the margin of adjacent capsules.

Twenty to 50 ova in each capsule, almost all of which seem to reach full development. On upper surface of each capsule at apex, is a rounded, elliptical depression, marking site of future opening for

<sup>290</sup> Lat., *lunatus*, crescent-shaped.

<sup>291</sup> Gr., *ana*, to, up?; -Lat., *avarus*, greedy; *semi*, half; *plicatus*, folded.

escape of young. Perry has seen *Anachis* penetrate capsules and devour the young embryos.

*Anachis avara similis*<sup>292</sup> (Ravenel)

Pl. 31, fig. 225

Alt. to 10 mm. Characters of shape and color those of *A. avara semiplicata*, about one-third smaller; six whorls; 17 or 18 axial ribs, intercostal spaces spirally striate, strongest below. In juvenile specimens body whorl is slightly angulate at base.

Abundant on grassy bottom in shallow water.

*Anachis obesa*<sup>293</sup> (C. B. Adams)

Pl. 32, fig. 226

Alt., 4-6 mm. Shell small, ventricose, rotund; five whorls, spire almost half of height; sutures distinct, excavated; axial ribs, intercostal spiral striations; aperture oval, oblique; outer lip thin in young specimens, thickened and denticulate in adult; base of columella denticulate.

Abundant on weedy bottoms. Many found among branching hydroid colonies and on shells of living *Atrina*.

Genus **NITIDELLA** Swainson, 1840

*Nitidella nitidula*<sup>294</sup> (Sowerby)

Pl. 51, fig. 346

Alt., 9 mm. Shell oblong-ovate, smooth, shining, whitish, marbled with brown; spire short and acute, of about two whorls, followed by five or six rounded whorls; sutures distinct. The body whorl is 7 mm. in length, rounded, 4 or 5 mm. in diameter slightly above center of the shell. Aperture the length of the body whorl, anal canal narrow and deeply notched; columella sinuous, with two small plications; outer lip thickened, denticulate within; operculum corneous, small.

Littoral regions, under rocks and detritus.

Genus **COLUMBELLA** Lamarek, 1799

*Columbella*<sup>295</sup> *rusticoides*<sup>296</sup> Heilprin

Pl. 31, fig. 223

Alt., 28 mm. Small, ovate, smooth; white ground color maculated and reticulated with bright chestnut-brown; soft, hispid epidermis; six or seven convex whorls, spire short, acute; body whorl

<sup>292</sup> Lat., *similis*, like.

<sup>293</sup> Lat., *obesus*, fat, stout.

<sup>294</sup> Lat., *nitidus*, shining, sleek, fat; *nitidula*, field-mouse, shrew-mouse.  
—Cicero.

<sup>295</sup> Lat., *columna*, column; *bella*, pretty, elegant.

<sup>296</sup> Gr., *russus*, russet, red.

more than half of height, sutures distinct; fine equidistant spiral striations, much stronger over lower portion of shell; aperture narrow, length of body whorl; outer lip thickened, its inner margin with a central convexity, crenulate with purple stain in intervening sulci; columella curved, deep notch near base, denticulate below with dark stain between teeth; operculum corneous, small.

Shallow water. Often among grasses and about old pilings.

#### Family NASSARIIDAE

The family Nassariidae is represented in all seas. They are small animals but none the less destructive of other molluscan life through their carnivorous appetites and predatory habits. Animals of *Nassarius vibex* have been seen by Perry to pierce the egg capsules of *Cantharus floridanus* and devour the contents.

The shells are ovate, more or less rotund with acuminate spire, short anterior canal and extensive columellar callus. The operculum is corneous, unguiculate, its edges often irregular or serrate.

#### Genus NASSARIUS Dumeril, 1806

*Nassarius ambiguus antillarum*<sup>297</sup> (d'Orbigny) Pl. 32, fig. 229

Alt., 15 mm.; spire, 9 mm. Shell conic-ovate, cream-white with scattered brown markings in interrupted spiral bands, often a dark band at sutures; thin epidermis; seven whorls, shoulders almost at right angles to vertical axis of shell; whorls strongly ribbed from apex to base, 11 ribs on body whorl; overlaid spiral sculpture of closely placed ridges; aperture oval, outer lip thick in adult, thin in juvenile specimens, sharply crenate within, with smaller marginal denticulations; columella arcuate, small horizontal plications, pronounced callus; anterior canal open, recurved.

Dredged in four to six fathoms.

*Nassarius consensus*<sup>298</sup> (Ravenel) Pl. 32, fig. 230

Alt., 12-14 mm. Cream-white with faint markings of purplish brown, darkest between ribs; spire half height of shell; seven ribbed, convex whorls; about nine ribs on body whorl; fine spiral threads cross ribs and interspaces; aperture oval, strong varix posterior to

<sup>297</sup> Lat., *nassa*, a basket for catching fish; *ambiguus*, wavering; of the Antilles.

<sup>298</sup> Lat., *consensus*, agreement.

outer lip; other characters typical. Dredged in three to six fathoms.

*Nassarius vibex*<sup>299</sup> (Say)

Pl. 32, fig. 231

Alt., 10-14 mm. Shell conic-ovate, apex acute, nuclear whorls dark; body whorl ventricose; sutures shallow; cream-white, yellowish, flecked with brown; occasional dark-brown individuals; about seven flattened whorls without distinct shoulders; axially ribbed, 12 ribs on body whorl; spirally striate by coarse threads which cross and crenate ribs; aperture oval, outer lip with thick varix, crenate within; columella arched, crenate below, callus expanded over body whorl; anterior canal short, recurved.

Common and abundant in littoral region, both on sandy and grassy bottoms. Often congregates in large numbers on egg ribbons of *Busycon "contrarium"*.

Egg capsules of *Nassarius vibex* (Say)

Pl. 51, figs. 347a, b, c

#### Family BUCCINIDAE<sup>300</sup>

This family is best represented in northern seas. Its genus *Buccinum* is circumboreal. But two species belonging to the genus *Cantharus* are reported from the western coast of Florida.

#### Genus CANTHARUS Röding, 1795

*Cantharus tinetus*<sup>301</sup> (Conrad)

Pl. 32, figs. 232a, b

Alt., 28 mm. Shell smoothly ovate, six whorls, spire evenly conic; body whorl large, sutures indistinct; variegated color pattern of blue-gray, chocolate- and chestnut-brown, yellow and milk-white; darkest at apex; one of the few shells showing a definite blue coloration; axial ribs more or less well developed, 11 on body whorl; revolving larger and smaller ridges cross both ribs and interspaces; aperture long-oval; outer lip thick in adult—thin in juvenile—specimens, edge and interior crenate. Columella arched, one strong fold near upper angle of aperture; anterior canal almost straight, slightly recurved; operculum corneous, pyriform, apical nucleus.

Fairly common in littoral regions on grassy bottoms, about submerged pilings, logs and oyster bars, and in open water to six fathoms.

Egg capsules of *Cantharus tinetus* (Conrad)

Pl. 51, figs. 348a, b, c

<sup>299</sup> Lat., *vibex*, the mark of a blow.

<sup>300</sup> Lat., *buccina*, *bucina*, a crooked trumpet.

<sup>301</sup> Gr., *kantharos*, drinking cup; Lat., *tinetus*, painted.

Subgenus **PSEUDOSALPINX** Olsson and Harbison, 1953

**Cantharus floridanus** (Conrad)

Shell solid, fusiform, the spire and anterior canal of nearly equal length, the whorls shouldered. Anterior canal stout, straight, becoming recurved at end, narrowly perforate or closed. Aperture subovate above, narrowed in front, the outer lip lirate within. Inner lip, concave, with a smooth, unarmed, callous wall.\*

Egg capsules of **Cantharus floridanus** (Conrad)

Pl. 50, fig. 342

**Cantharus multangulus** (Philippi)

Pl. 31, fig. 219

Alt. up to 32 mm. Ground color cream, flecked and spirally striate with brown, occasional specimens unicolored orange; epidermis pale brown, hispid in fresh shells. Spire about half of altitude, five whorls below two smooth nuclear whorls; body whorl large, sutures distinct, slightly excavated, whorls well separated. Sculpture of seven strong rounded varices interrupted at sutures, angled at periphery of whorls, not extended to base of body whorl. Revolving sculpture of fine threads over entire surface, stronger spirals at intervals below periphery of whorls. Aperture oval, outer lip thin, crenate; canal short, open. Operculum corneous, fusoid.

From littoral zone to five fathoms.

Egg capsules of **Cantharus multangulus** (Philippi)

Pl. 50, figs. 340a, b

Family **NEPTUNEIDAE**

This group is represented among the molluscan fauna of polar, temperate, and tropical seas. As would be expected from such diverse conditions of environment, ecological influences have resulted in great diversity of form among members of the group.

Genus **BUSYCON** Röding, 1798

**Busycon "contrarium"**<sup>302</sup> (Conrad)" (perversum of authors)

Pl. 33, fig. 233a; Pl. 34, figs. 233 b, c

Alt. to 300 mm. Shell sinistral, pyriform. Young specimens vary in color through fawn, brown and gray tones, often centrally banded

<sup>302</sup> Gr., *busycon*, a large, coarse fig; Lat., *contrarius*, *contra*, against.

\* Olsson and Harbison, 1953. Pliocene Mollusca of Southern Florida. *C. floridanus* (Conrad) has been designated as the type of the new subgenus.

with light color, epidermis brownish; old living shells usually without color, worn and covered with a growth of marine algae. Albino specimens are not uncommon. Spire short, body whorl large, shoulder of whorls tuberculate or smooth; sutures distinct, slightly channeled; revolving sculpture of coarse threads; aperture large, widely open, prolonged into a long, straight, open canal; columella a little sinuous, outer lip sharp, lirate within; operculum ovate.

Deformities of shells of *B. "contrarium"* are more frequently encountered than in the shells of any other species of gasteropod found in this region. The most common abnormalities involve the long canal, which may be contorted and bent in almost any direction and at any angle. Occasional specimens show partial or complete duplication of the canal.

Perry has observed a few embryonic shells from fresh egg ribbons which show abnormalities of development similar to those seen in some adult shells of 50 to 100 millimeters height.

An aberrant form of *B. "contrarium"*, Plate 34, figures 233 b, c, is found in a fairly circumscribed area of the Gulf of Mexico toward the eastern end of Sanibel Island. Shells and living mollusks of this form have not been found elsewhere in the vicinity. The shells approach the type of *B. perversum* (Linne). They are thicker, heavier, more solid, the shoulder wider and more sloping, the peripheral tubercles stronger and more widely spaced, the spire flatter, aperture wider and canal much shorter than in the common *B. "contrarium"*. The columella is thick, with a tumefaction at the site of the columellar thickening of *B. perversum*, Plate 34, figures 233, D. E. The prominent characters of this shell are the squat outline—a reversed pyramid; its weight and solidity; the decidedly great proportion of shoulder breadth to the total height and the thick, swollen columella.

Egg capsules of *Busycon "contrarium" (Conrad)* Pl. 51, figs. 349a, b, c

*Busycon "contrarium"* produces long twisted ribbons of from 30 cm. to more than a meter in length, closely set along one side with disc-shaped capsules 30 mm. in diameter. The capsules are four to five mm. thick and have free ruffled margins on each flat side. *Busycon*

lays her eggs while buried in sand with the siphonal canal protruding obliquely. The proximal end of the egg ribbon is firmly fixed. The last few capsules are always abortive and seldom contain ova. One ribbon bears from 50 to 175 capsules, each containing from 25 to 200 ova. *Busycon* is predatory and carnivorous. It is destructive to the common edible clam and to scallops. It has been seen preying upon *Ostrea*, *Atrina*, *Spisula*, *Fasciolaria* and *Vermetus* and it probably attacks any mollusk which its large foot can hold and manipulate.<sup>303</sup>

Careful inspection of embryos from many individual capsules of *Busycon* "*contrarium*" has shown a sufficiently definite proportion of shell deformities, similar to those of adult shells, to suggest that such distortion may be congenital, not acquired.

Subgenus **BUSYCOTYPUS** Wenz, 1943

***Busycon spiratum***<sup>304</sup> (Lamareck)

Pl. 33, fig. 234

Alt., 90-100 mm., occasional specimens up to 130 mm. Shell pyriform, outline smooth, no sculpture other than coarse and fine spiral ridges, more oblique below. Ground color cream, longitudinal streaks of chestnut-brown, thin epidermis; spire short, body whorl large, sutures wide, and deeply channeled; aperture wide, prolonged into straight, open canal, operculum oval, corneous, brown.

Sandy bottoms from littoral zone to four fathoms.

A sinistral specimen of *B. spiratum* is described by Burnett Smith, *Nautilus*, vol. 52, No. 3.

Egg capsules of ***Busycon spiratum*** (Lamareck)

Pl. 52, figs. 350a, b, c, d

The egg ribbon of *Busycon spiratum* is shorter than of *B. "contrarium"* seldom more than 35 cm. long. The disc-shaped capsules

<sup>303</sup> A bivalve—in described instance an oyster—was held in the foot with the hinge behind the canal, in case of clam, the hinge was toward the columella, but in both cases the edge of the bivalve was left free. *Busycon* rests on foot with canal directed upward at angle about 30 degrees. The foot is strongly contracted about six times a minute, and the edge of the oyster is brought against the inner edge of the lip with considerable pressure and then drawn inward and toward the canal. A small piece is chipped from the edge of the oyster shell and the process is repeated until a gap is made large enough to admit the radula which then tears out the flesh. This method of getting at the animal explains the roughened and chipped condition of the lip of *Busycon*, and the chipped oyster and clam shells. Occasionally I have found a live quahog with its edge much chipped, so the whelk does not always succeed.—*Feeding Habits of Busycon*, Shields Warren, vol. 30, *Nautilus*.

<sup>304</sup> Lat., *spira*, coiled, wreathed; *pyrum*, pear.

are smaller, thinner, with sharply cut points about their edges. They are closely distributed along a connecting cord to the number of 5 to 100. From 15 to 50 eggs are in each capsule. The proximal end of the ribbon is fixed in the sand.

Genus **MELONGENA** Schumacher, 1817

**Melongena corona**<sup>305</sup> (Gmelin)

Pl. 33, figs. 235a, b, c, d

Alt., to 110 mm. Shell ovate, short spire; large, inflated body whorl; spirally banded with white, brown and amber shades in irregular arrangement; shoulder of whorls sloping, slightly concave; periphery of body whorl and one or more preceding turns with one, two or three rows of sharp, semitubular spines; lamellar extension of spines cross shoulder and sutures to body of whorl above. The spines may be horizontal, crest incurved, or rarely, recurved; always at site of an earlier aperture. A row of spines, single, double or treble may encircle base of shell, marking locations of notches at bases of former apertures. Aperture wide, oval; deep, recurved notch at base; outer lip simple; columella twisted, thin columellar callus; operculum oval, dark brown. Shells often covered by an adventitious growth of marine algae.

Common and abundant in shallow water; prefers muddy bottom.

Egg capsules of **Melongena corona** (Gmelin)

Pl. 52, figs. 351a, b, c

*Melongena corona* spawns from January to June, in shallow water, quite unaffected by exposure between tides. The round, flat, thin capsules from 14 to 30 mm. in diameter, are placed in regular rows of a few more or less than 10. They are supported on a common ribbonlike base, which peels readily from its attachment, usually shells, especially oysters or submerged pieces of wood. The number of small ova in each capsule is rarely less than 25, frequently more, but only a small proportion develops to embryonic maturity.

The shells of *M. corona* are exceedingly variable in size, relative proportions, development of spines and in color; forms intermediate between extreme variations may usually be found in any locality

<sup>305</sup> Fr., *melongenc*, eggplant; Lat., *corona*, crown.



where the mollusks are abundant.

The subspecies and variants most important to students interested in west Florida types are *M. corona inspinata* Richards, which has square shoulders without trace of spines or tubercles. Taken near Sarasota.

*M. corona perspinosa* Pilsbry, attains large size, shoulder spines horizontal, one, two or three rows; well-developed basal series of spines. From Tampa Bay to Lossman's River.

*M. corona subcoronata* Heilprin, less height and greater width than *M. corona*, one series of horizontal shoulder spines, and one basal series.

*Melongena* is predatory upon both pelecypods and gasteropods, and as many as eight individuals have been seen together devouring a living horseshoe crab. The animals respond within a short interval of time to a current-borne taint—always approaching in a direct line and against the current, toward the anticipated meal.

The following account of the attack of *Melongena* upon the large bay scallops was given by a Sanibel net fisherman—"Out on the flats when we are sitting in the boat waiting for the tide to turn, we can see the crown conchs creepin' up on the scallops on the bottom; the old conch will slide up to about three or four inches from the scallop and then leap on him—they hold the scallop in their foot and stick their trunk through the little nick below the scallop's ear. The scallop flaps his shell to get away but this only gives the conch the chance to get his trunk in deeper".

#### Family FASCIOLARIIDAE

This family, whose members are generally distributed throughout warm seas, counts among its species one of the largest known univalve shells, *Fasciolaria papillosa* Sowerby. Other species of the group have shells of diminishing size to the one inch altitude of a small *Leucozonia*.

The animals are sluggish in movement and somewhat timid, although they are both predatory and carnivorous, pelecypods and gasteropods are indiscriminately attacked by them. They have been seen to prey upon *Strombus*, *Melongena*, *Mercenaria* ("Venus"), and *Pecten*.

The shells of this group are strong and thick, fusiform with conic spire, and straight anterior canal; the aperture is generally long-oval, the outer lip simple, not thickened and the columella plicate. The operculum is corneous, oval, acute at the apical nucleus.

Genus **FASCIOLARIA** Lamarck, 1801

**Fasciolaria papillosa**<sup>306</sup> Sowerby (*F. gigantea* Kiener) Pl. 35, fig. 236

Alt., to 600 mm. Color warm, deep salmon-pink, often lighter in shade; occasional albino specimens in which the operculum is a light brown; interior smoky or bright pink; thick, deciduous epidermis; about 10 shouldered whorls; apex bluntly rounded, spire elongate, body whorl large; sculpture of revolving cords separated by grooves; strong growth lines; shoulders nodulous or not; aperture wide, oval, contracted at base into a slightly oblique, relatively short and narrow open canal; outer lip lirate within; columella incurved with three oblique plications above mouth of canal; animal brilliant red. In some localities it is known as the "pepper conch".

From shallow water to five fathoms.

Egg capsule of **Fasciolaria papillosa** Sowerby Pl. 52, figs. 352a, b, c

*Fasciolaria papillosa* deposits vase-shaped capsules, about 40 mm. in height, of rather rough texture, encircled by three broken ridges at equal intervals between base and top. The free margin at the top is fluted and flaring. In the center of the top is a small round aperture closed by a thin disc which disappears to permit the escape of the mature embryos. The individual capsules are distributed along one side of a strong ribbon, 15 mm. wide, so twisted upon itself that the appearance of the nidus is that of a huge rosette. These rosettes are sometimes unattached but more frequently fastened to old shells—often clam shells. One nidus may contain from 50 to 200 capsules with embryos in various stages of development.

The embryonic heart of *Fasciolaria papillosa* beats from 115 to 125 times per minute; not regularly, but with 22-25-10-21-37-20-12 strong contractions, each group separated by pauses of three to seven seconds, as observed in many embryos during 15 minute periods.

<sup>306</sup> Lat., *fasciola*, a band; *giganteus*, gigantic; *papilla*, nipple.

**Fasciolaria papillosa reevei** Jonas in Philippi

Pl. 48, fig. 287

Alt. to 150 mm. General character of *F. papillosa*, smaller, thinner; early whorls with nodulous shoulder similar to the species, body whorl with smooth shoulder, not ribbed nor nodulous.

Found on the Gulf Coast of Florida with *F. papillosa*.

**Fasciolaria tulipa**<sup>307</sup> (Linné)

Pl. 35, figs. 237a, b

Alt. to 150 mm. Shell fusiform, seven to nine convex whorls; well-defined sutures; ground color light with interrupted spirals of brown, more or less maculated with brown or amber color; thin periostracum; revolving sculpture of flat ridges and shallow grooves, strong and wrinkled below sutures; regularly spaced growth lines; aperture long-oval, outer lip simple, finely lirate within; columella inflected, with two oblique folds below; canal short, open, oblique.

From littoral zone to five fathoms.

*Fasciolaria tulipa* "*scheepmakeri* (Dunker) Melvill" corresponds with the typical form in all general characters. Its surface is rugosely sculptured with spiral ribs and ridges.

Egg capsule of **Fasciolaria tulipa** (Linné)

Pl. 53, figs. 353a, b, c

Egg capsules of *Fasciolaria tulipa* and *F. hunteria* resemble those of *F. papillosa* in their vase shape but are smaller, of smooth texture, and always fixed to a firm base. *F. tulipa* usually selects a dead shell for support, while *F. hunteria* is satisfied with an old wood piling or another egg case if a suitable shell is not at hand. She continues her egg laying even when left dry between tides.

Individual capsules of *F. tulipa* are from 25 to 30 mm. in height, with finely fluted edges at the top, and like others of the genus, have a small round central opening in top of capsule closed by a thin disc. From 20 to 75 capsules compose a compact rosette, with 8 to 20 embryos in each capsule. Development of embryos is unequal, some in the same capsule being far more advanced than others. This is also true of others of the genus.

<sup>307</sup> N. L., *tulipa*, a flower.

When freed from the capsule, the young *Fasciolarias* are unpigmented, but become dark in from 24 to 36 hours.

***Fasciolaria hunteria***<sup>308</sup> (G. Perry) (*F. distans* Lamarek) Pl. 35, fig. 238

Alt., 75 mm. General characters of *F. tulipa*; but smaller, smoother, ashy or bluish gray with longitudinal stripings of white; about 14 narrow revolving dark-brown lines; spiral sculpture at base only.

Egg capsule of ***Fasciolaria hunteria*** (G. Perry) Pl. 53, fig. 354

The capsule of *Fasciolaria hunteria* is smaller than that of *F. tulipa*, from 12 to 15 mm. in height, smooth, with a simple margin at the top, save for a single fluting on one side. From six to twenty capsules on a common base form a perfect rosette.

These three species spawn from December through May; *F. tulipa* first, closely followed by *F. hunteria*, while the cases of *F. papillosa* are seldom seen before February.

#### Genus **LEUCOZONIA** Gray, 1847

***Leucozonia cingulifera***<sup>309</sup> (Lamarek) Pl. 35, fig. 239

Alt., 40 mm. Shell pale brown to black, light band near base, thin epidermis; fusiform, about eight whorls, sutures distinct; spire conic, lower three whorls angulated at periphery by about ten low rounded ribs; spiral sculpture of coarse and fine threads. Aperture oval, outer lip simple, lirate within; columella white, four oblique plications; anterior canal oblique, not curved; operculum typical, animal color of raw beef.

Dredged about rocks and coral reefs in four to six fathoms.

#### Family **XANCIDAE**

A group of mollusks native to warm oceans. Included in this family is the Chank-shell, sacred to the Hindus, and often portrayed in the hand of the god Vishnu.

<sup>308</sup> Lat., *distans*—*antis*, standing apart; named for Governor of Australia Hunt, 1811.

<sup>309</sup> Gr., *leukos*, white; Lat., *zona*, a girdle; *cingula*, belt; *ferre*, to bear.

Genus **VASUM** Röding, 1798**Vasum muricatum**<sup>310</sup> (Born)

Pl. 36, figs. 240a, b

Alt., 60; diam. at periphery of body whorl, 42 mm. Shell heavy, solid, white; thick, rugose brownish epidermis; about eight whorls; apex acute, spire rises abruptly from penultimate whorl; sutures not well defined; outline of body whorl triangular, base narrow, shoulder nearly flat above periphery; about 10 broad, rounded ribs produced into sharp, prominent tubercles at periphery of body and penultimate whorl; revolving longer and smaller ridges; two or three series of spinous processes about base; aperture long, rather narrow, recurved notch at base; outer lip crenulate with external sculpture; columella with five, unequal central folds; umbilical notch at base; operculum corneous.

Fresh shells dredged about reefs and rocky bottom in four to six fathoms.

Family **VOLUTIDAE**

The shells of many members of this family are rare and expensive. Little is known of the habits of the animal. They are believed to be carnivorous, and Australian and South American species have been found in shallow water feeding upon *Mytilus*.

Distribution of members of the family is confined to tropical and subtropical seas.

Genus **SCAPHELLA** Swainson, 1832**Scaphella junonia**<sup>311</sup> (Shaw)

Pl. 36, fig. 241

Alt., 45; extreme alt. about 140 mm. Shell smooth, elongate-ovate; pinkish ivory with revolving rows of rich mahogany-red squarish spots; about five whorls; apex rounded, brown; spire short, sutures distinct; early whorls finely ribbed, cancellated by spiral threads; aperture elongate, notched at base, outer lip simple, sharp; columella involute, with four oblique folds; no operculum. The animal is strikingly marked with velvet-black spots and blotches on an ivory-pink ground color.

Living specimens from 30 to 70 millimeters height have been dredged about rocky reefs about one and three to four miles off

<sup>310</sup> Lat., *vasum*, a vessel; *muricatus*, sharp, prickly.

<sup>311</sup> Gr., *scaphe*, a bowl; *Juno*, consort of Jupiter.

Blind Pass, Sanibel Island. Many shells are taken by the sponge divers of Tarpon Springs. *S. junonia* has been taken in eight fathoms from Tampa Bay to the Florida keys and one living specimen was dredged in the Gulf Stream off Palm Beach, Florida.

Subgenus **AURINIA** H. and A. Adams, 1853

***Aurinia kieneri ethelae*** Pilsbry and Olsson

Pl. 53, fig. 355

Alt., 182 mm.; greater diam., 54.5 mm. Shell spindle-shaped, not thick; pinkish cinnamon, with six widely separated, revolving rows of squarish spots of dark brown; spire a little over one whorl, with an elevated, acute point; about five whorls, the first two with about 17 narrow axial riblets, which diminish rapidly on the next whorl; spiral sculpture strong, except on body whorl which is nearly smooth except for longitudinal lines of growth; aperture two-thirds of length of shell; outer lip thin and flattened, the lower edge sharply curved to the notched canal; columella straight and smooth, without plaits; operculum missing. Dredged in the Gulf from Mississippi, as far south as Tampa.

This is a longer, thinner and more graceful shell than *Scaphella junonia*, differing especially in its lack of oblique folds on the columella.\*

#### Family **MARGINELLIDAE**

The mollusks of this family are small sand dwellers, living only in warm seas with a range in depth from the intertidal zone to a thousand fathoms.

Many of the animals are beautifully marked with spots of brilliant color; the foot is large, the siphon long and the mantle is reflected over the greater part of the shell.

The shells are highly polished, porcelaneous, with an extremely short spire and large rounded body whorl. The aperture is long and narrow, the outer lip thickened and the columella is always plicate. Operculum usually absent.

Genus **MARGINELLA** Lamareck, 1799

***Marginella apicina***<sup>312</sup> Menke

Pl. 36, fig. 242

Alt., 12 mm. Shell small, smooth, polished; ivory or yellow,

<sup>312</sup> Lat., dim. of *margo*, rim, margin; *apex*—*icis*, apex.

\* Pilsbry, H. A. and Olsson, A. A.: *Nautilus*, vol. 67(1). Condensed description.

usually with three brownish spiral bands, several reddish-brown spots on outer lip. Spire short, flattened, body whorl large, shoulder convex, aperture almost length of shell, narrow, notched at base; outer lip thickened—thin in young specimens; columella with four sharp folds below.

Shallow water. In sand or on grassy bottoms.

The small mollusks are alert and active and respond quickly to the presence of food in the neighborhood. They are carnivorous.

*Marginella apicina virginea* Jousseaume is a pure white or flesh-colored form of *M. apicina*.

Egg capsules of *Marginella apicina* Menke

Pl. 53, figs. 356a, b, c

*Marginella aureocincta*<sup>313</sup> Stearns

Pl. 36, fig. 243

Alt., 4 mm. Shell translucent, white, usually with two amber-colored spiral bands; fusiform, spire elevated, body whorl a little more than half height; sutures distinct, overlaid with glossy enamel; aperture almost length of body whorl, narrow, wider at notched base; outer lip thick, columella with four oblique folds.

Common and abundant on grassy and sandy bottoms, often creeping over marine grasses.

*Marginella denticulata opalina*<sup>314</sup> Stearns

Pl. 36, fig. 244

Alt., 8 mm. Shell smooth, polished, light- or dark-amber color, often with band of darker color, fusiform, five whorls; spire elevated, body whorl contracted at base, suture distinct; aperture little more than half height of shell; outer lip thick, columella with four oblique plications.

With other Marginellas. Often among marine grasses.

*Marginella minuta*<sup>315</sup> Pfeiffer

Pl. 53, fig. 357

Alt., 2.5 mm. A minute *M. apicina*. White, translucent, polished; outer lip finely denticulate within, columella with four oblique folds.

*Marginella succinea*<sup>316</sup> Conrad

Pl. 36, fig. 245

Alt., to 14 mm; body whorl, 9 mm. Shell smooth, translucent, highly polished, pale yellow; five whorls; spire moderately elevated,

<sup>313</sup> Lat., *aurum*, gold; *cinctus*, girdled.

<sup>314</sup> Lat., *dens, dentis*, tooth; *opalus*, a precious stone.

<sup>315</sup> Lat., *minutus*, small.

<sup>316</sup> Lat., *succineus*, amber colored.

body whorl long; sutures distinct, enameled; a fine parallel line below sutures; aperture long, widest at notched base; outer lip thick, sinuous—with internal convexity near middle; columella with four oblique folds below.

In shallow water, sandy stations. Often within dead shells. Dredged in one to five fathoms.

*Marginella hartleyana*<sup>317</sup> Schwengel

Pl. 53, fig. 358

Length, 7.3 mm. to 8 mm.; width, 4 mm. to 4.5 mm.

Shell small, polished, spire slightly conic, with obtuse apex, of about 4.5 whorls; suture shallow, aperture narrow and nearly as long as the shell, outer lip thickened and slightly incurved; four oblique plaits on the columella, the first, second, and third being increasingly larger, the fourth diminishing to the size of the second. The shell is pale ochraceous-salmon color, thickly covered with minute, irregular flecks of ochraceous-salmon, which form three faint, indistinct bands around the body whorl. There is a narrow band below the suture which is without flecks, and they evanesce toward the heavily bevelled lip, which is much paler in color, being almost white.

Dredged in 15 to 18 fathoms, northwest Florida.

Genus **CYPRÆOLINA** Cerulli-Irelli, 1911

(*Gibberulina* Monterosato, 1884)

*Cypræolina laerimula*<sup>318</sup> (Gould)

Pl. 36, fig. 246

Alt., 2.25 mm. Shell minute, polished, translucent, white; spire obscure, depressed, covered by enamel; body whorl rounded; aperture long, narrow, curved above; outer lip protracted beyond apex, fine denticulations within; columella with four oblique folds.

In shallow water—usually among grasses.

#### Family **OLIVIDAE**

The Olividae is a family of tropical and subtropical distribution. Warm seas of both hemispheres have representative genera whose species vary in size but share in the family characters of a large foot divided transversely into an anterior propodium and a vol-

<sup>317</sup> Named for Hartley Starkey.

<sup>318</sup> Lat., *lacrima*, a tear.



uminous posterior portion which is reflected well over the sides of the shell.

The shells are smooth and highly polished; usually subcylindrical and short-spined with a greatly lengthened body whorl and long, narrow aperture; no operculum.

Genus **OLIVA** Bruguière, 1789

**Oliva**<sup>319</sup> *sayana* Ravenel

Pl. 36, fig. 247

Alt., 50-60 mm. Shell subcylindrical, polished and shining; ground color cream or grayish, overlaid with angular pattern of brown with pale-tinted central band, darker markings above and below; spire short, acute, nucleus minute, glassy, opaque; five or six whorls, "enroule"; body whorl lengthened, about five-tenths of altitude; one plicate revolving fold near base; sutures deeply channeled; aperture long, obliquely notched at base; outer lip thickness of shell, not reflected; columella plicate below, slightly sulcate above; no operculum.

**Oliva** *sayana citrina*<sup>320</sup> Johnson

A golden-yellow or pale-yellow form of *O. sayana* peculiar to the Gulf Coast of Florida. Pure albino specimens occur, but are rare.

*Oliva* lives in sandy stations. The animals are gregarious and move in large groups from one location to another. They burrow about an inch beneath the surface of the sand, with only the extreme tip of the long slender proboscis exposed and the broken trail in the sand is like that of a mole in soft earth.<sup>321</sup> Forward movement is by alternate advance and rest periods.

A number of specimens of both types of *Oliva* have been found which have a strong revolving cord at or near the center of the body whorl. The cord is continuous from columella to edge of outer lip.

<sup>319</sup> Lat., *oliva*, olive.

<sup>320</sup> Lat., *citrinus*, yellow.

<sup>321</sup> Mr. Ernest H. Noyes, at Naples, Florida, has taken living *Oliva* in a Lyman trap baited with sand fleas. F. Lyman, Lantana, Florida writes—"For many years we have had frequent reports from Palm Beach pier that fishermen catch *Oliva* on hooks while fishing for pompano. Sand fleas are used one hundred per cent for pompano bait."

Genus **OLIVELLA** Swainson, 1831**Olivella pusilla**<sup>322</sup> Marrat

Pl. 36, fig. 248

Alt., to 12 mm. Shell almost a miniature *Oliva*, spire more produced, aperture shorter; mutable in color and pattern. Individuals vary through ashy shades and brown, unicolored, banded with white or finely reticulate with chestnut-brown. Less common color variations are dark brown and pure golden-yellow. Corneous operculum, thin, semioval, apical nucleus.

Common in shallow water, usually in sand. A bay species.

Egg capsules of **Olivella pusilla** Marrat

Pl. 55, figs. 362a, b, c

**Olivella floralia**<sup>323</sup> Ducloux

Pl. 36, fig. 249

Alt., to 15 mm. Shell fusiform, more slender with more elevated spire than *O. pusilla*. Five or six whorls; white, apex dark or yellowish, body whorl often faintly marked with dull bluish gray; operculum typical.

Sandy stations in shallow water. Not often taken in inside waters.

**Olivella blanesi** Ford

Pl. 36, fig. 250

Alt., to 8; diam., 3.1 mm. Shell white, translucent; ovate; five whorls, body whorl rotund; spire rather sharp; suture channeled; aperture half the altitude of shell, angulate above, widest below middle, with wide basal notch. Columella "very short, vertical, cylindrical and smooth, making a decided angle with a parietal wall, forming a deep sulcus".

The species is described as having three spiral series of irregularly formed crimson spots, one of small spots at the suture, the other at center and base, the rest of the surface showing a fine reticulation of the sand color. This color character seems to fade quickly in dead shells.

On sand flats beyond low tide mark. In beach drift.

Family **TEREBRIDAE**

The Terebridae is a family of carnivorous mollusks native to tropical and subtropical seas, principally in shallow water and

<sup>322</sup> Lat., *pusillus*, very little.<sup>323</sup> Lat., *floris*, flower.

generally in sandy stations.

The shells are elongate and tapering, with whorls regularly increasing in size. A short aperture terminating in a recurved basal notch.

Genus **TEREBRA** Bruguière, 1789

Subgenus **STRIOTEREBRUM** Sacco, 1891

**Terebra dislocata**<sup>324</sup> Say

Pl. 37, fig. 251

Alt., to 40 mm. Shell elongate, tapering regularly to acute apex; color an indefinite blend of ashy blue and brownish tones, apex dark; about 15 flattened whorls, sutures distinct; sculpture of close longitudinal plicature cancellated by spiral grooves; nodulous band below sutures; aperture small, outer lip thin; columella short, recurved into basal notch; operculum corneous, translucent, yellowish, apical nucleus.

Abundant on sand bars exposed at extreme low tide.

**Terebra concava vinosa**<sup>325</sup> Dall

Pl. 37, fig. 252

Alt., to 22 mm. Shell with general characters of *T. dislocata*; smaller, upper whorls thin, color bluish gray with vinous tint, sometimes maculations of reddish brown, apex dark; about 13 whorls; sculpture of delicate longitudinal plications and spiral grooves; small subsutural band; operculum brown.

Most common in inside bays.

**Terebra protexta**<sup>326</sup> (Conrad)

Pl. 37, fig. 253

Alt., to 30 mm. Shell with general character of other *Terebras*; 13 to 15 whorls; lower portion of whorls brown, sutural band light; longitudinal plications convex over whorls, spiral sculpture obsolete or wanting over sutural band; operculum red-brown or claret color.

Dredged in three to six fathoms.

#### Family **CONIDAE**

The families Terebridae, Conidae and Cancellariidae compose a group of animals which share a quality unique in the phylum Mollusca—the possession of poison glands. The venomous secretion

<sup>324</sup> Lat., *tereбра*, a boring tool, *e.g.* auger; *dislocatus*, dislocated.

<sup>325</sup> Lat., *concavus*, hollow; *vinum*, wine.

<sup>326</sup> Lat., *pro*, before; *textus*, texture.

of these glands passes through a long duct into a minute channel in the teeth of the radula, and certain tropical species of *Conus* have been known to inflict dangerous and even fatal wounds upon human beings. Natives of South Pacific islands insist that some of the cones "spit poison" at an enemy.

The cones constitute a large family of many species, almost all native to tropical seas. Their stations are about reefs and rocky bottoms of moderate depths; some shallow water species have adopted sandy stations.

The animals are predatory and carnivorous, drilling through the shells of other mollusks in order to reach the soft parts.

The shells are distinguished for rich colors and varied patterns and elegant inversely conic shape. The whorls are rolled upon themselves below a small, sharp apex, the narrow aperture is as long as the body whorl and usually notched near the suture. The operculum is disproportionately small, corneous, unguiform, with apical nucleus.

#### Genus *CONUS* Linné, 1758

*Conus spurius*<sup>327</sup> *atlanticus* Clench ("C. *proteus* Hwass") Pl. 37, fig. 254

Alt., to 70 mm. Shell smooth, inversely conic, white, with revolving interrupted bands of orange- or chestnut-colored markings; thick brownish, translucent epidermis; about ten whorls, first two or three whorls of spire rise sharply from flattened shoulder of shell; sutures distinct; sculpture of growth lines and a few spiral threads at base; aperture length of body whorl, notched at suture, outer lip thin, outer and inner lip parallel, recurved notch at base; operculum brown, very small.

Dredged in three to six fathoms. Not uncommon on sand bars of inside waters.

Egg capsules of *Conus spurius atlanticus* Clench Pl. 54, figs. 360a, b, c, d, e

*Conus perryae*<sup>328</sup> Clench Pl. 37, figs. 258a, b

Alt., 12.5 mm.; width, 7 mm., length of body whorl 10 mm. Apex

<sup>327</sup> Lat., *conus*, cone; *sparsus*, speckled, spotted; *Proteus*, a sea god able to assume many diverse shapes.

<sup>328</sup> Named for Dr. Louise M. Perry. Clench, Wm. J.: *Johnsonia*, No. 6 p. 31 and 32.

obtuse, with a single spiral thread and above this a flattened ridge; shoulder rounded, sutures slightly canaliculate, edged along the upper margin of each whorl by a narrow band of brown; ground color bluish gray with closely placed revolving chestnut-colored striations, faint near the shoulder, stronger over expanded portion of body whorl, becoming elevated threads over narrowed basal portion; aperture oblique, narrowed above, regularly increasing in width to base of shell; outer lip thin, sharp; chestnut stain well within aperture; growth lines exceedingly fine and numerous; periostracum thin and pale brown; operculum thin and small for the relative size of the aperture.\*

*Conus sozoni*<sup>329</sup> Bartsch

Pl. 55, fig. 363

Alt., 17 to 100 mm.; max. width, 42 to 47.5 mm. Color white, with three pinkish brown bands; entire shell encircled with brown spots, which seem darker and more profuse on the bands. On the spire the brown markings are heavier and axially curved. About 12 or 13 whorls, spire concavely elevated, sutures distinct, each whorl strongly keeled. Body whorl is smooth, with 8 to 10 spiral ridges toward the base. Most adult shells have had the lip broken and are roughly mended, giving the shell a battle-worn appearance, though the pattern of bands and dots is fairly continuous. Aperture oblique, narrow; the outer lip thin and delicate, convexly curved forward; small, corneous operculum.\*

Beach specimens of *C. citrinus* and *C. verrucosus* have been found on the Gulf beaches of western Florida, but there seems little evidence for a local station.

*Conus floridanus* Gabb

Pl. 37, fig. 255

Alt., to 50 mm. Shell with general characters of *C. spurius*. About 12 whorls, spire acute, well elevated, ascent of whorls terraced; mottled and obscurely banded in yellow and white, scattered brown spots; epidermis thin, brownish.

\* Condensed description.

<sup>329</sup> Named for Sozon Vatikiotis. Bartsch, Dr. Paul.: Smithsonian Miscellaneous Collections, vol. 98, No. 1.

*Conus stearnsi* Conrad<sup>330</sup>

Pl. 37, fig. 256

Alt., to 18 mm. Shell with typical characters; color grayish, mottled with brown or olive-green, narrow spirals of white and brown dots and dashes; eight whorls, spire elevated, ascent of whorls terraced; shoulder of body whorl sharply keeled, upper half of whorl smooth, spirally grooved below; aperture narrow, outer lip sharp, convexly curved forward; small operculum.

In shallow water, generally on grassy bottom.

*Conus jaspideus*<sup>331</sup> Gmelin ("C. pygmaeus Reeve")

Pl. 37, fig. 257

Alt., to 30 mm; diameter at shoulder almost half of altitude. Shell with typical characters; bluish white, obscure violet-brown mottling, narrow spirals of alternate chestnut and white dots and dashes, interior violet tinted; thin epidermis; spire elevated, terraced, shoulder sharply keeled, slightly overhanging, upper one-fifth of body whorl usually smooth, strong revolving bands and grooves below; aperture with wide, deep posterior notch.

Egg capsules of *Conus jaspideus* Gmelin

Pl. 54, figs. 361a, b, c

*C. jaspideus* deposits three to eight thin, flat, triangular capsules, each 5 mm. across, usually in the interior of a dead shell. *Noetia ponderosa* affords a favored site and the capsules are always placed well within the cavity of the umbo. The ova number from three to seven per capsule.

#### Family TURRIDAE

The family Turridae is reported in all seas but certain of its groups are restricted to a limited range. Its species are difficult to identify and classify, and individuals of any one species are seldom abundant.

<sup>330</sup> From the quoted description, it will be seen that the name "*Conus pealii*" is incorrectly applied to the common small cone generally so designated "*Conus pealii*." New species. Pl. 3, Fig. 3. Shell conical; whitish, marked with light yellow irregular stripes: these markings on the whorls give them a nodulous aspect, being alternately white and yellow; spire acute; the whorls coroneted at their edges; body whorl transversed throughout with deep transverse grooves, forming regular rounded ribs; less than an inch, and half as broad." Trans. Albany Inst. vol. 1, 1830, Art. XIII.

<sup>331</sup> Lat., *iaspidis*, of jasper, dull red.

The shells are of many and varied forms; usually fusiform with elongate spire, straight anterior canal and posterior notch or slit. The strongest sculpture is longitudinal. Most of its genera are operculate.

Genus **FENIMOREA** Bartsch, 1934

**Fenimorea moseri**<sup>332</sup> Dall

Pl. 38, fig. 259

Max. alt., 30; body whorl, 15.5; max. diam., 10 mm. Shell elongate-turreted, rather thick; color varies from rose-pink to a waxy-cream color; thin yellowish epidermis; about 10 whorls crossed by 11 axial ribs; ribs slightly keeled and retractively curved above periphery of whorl, constricted and drawn together at base of body whorl; revolving sculpture of fine threads from apex to base; fine incremental lines; aperture two millimeters in diameter; posterior sinus round, broad, subsutural; anterior canal short, straight; columella white, strong reflected callus below; operculum corneous, amber color, apical nucleus.

Dredged in six fathoms off Little Carlos Pass and Sanibel Island, Florida.

Genus **CERODRILLIA** Bartsch and Rehder, 1939

**Cerodrillia**<sup>333</sup> **clappi** Bartsch and Rehder

Pl. 38, fig. 260

Alt., 11.8 mm.; greatest diam., 4.5 mm. Shell smaller and more slender than *C. thea* and *C. perryae*; elongate-turreted, waxy white with a faint fawn-colored band "anterior to the broadest expansion of the axial ribs", and a broader band at periphery of body whorl; wide interspaces with faint spirals, and microscopic growth lines; aperture oval, short anterior channel, hardly more than a deep notch; edge of outer lip strongly convex with deep posterior sinus and shallow anterior notch; a stout varix immediately posterior; columella with fine, faint threads, heavy callus above; operculum light amber color.

Dredged in four to seven fathoms off Sanibel and Captiva islands, Florida.

<sup>332</sup> Named for Lt. J. F. Moser, U.S. Navy, collector.

<sup>333</sup> Gr., *keros*, wax; D., *drillen*, to bore.

***Cerodrillia perryae* Bartsch and Rehder**

Pl. 38, fig. 260A

Alt., 12.9; greatest diam., 5.3 mm. Shell elongate-turreted, flesh colored, a broad golden-brown band, from middle of turns to a little beyond periphery. Eight and a half whorls . . . Post-nuclear whorls moderately rounded, marked by strong, distinctly spaced, broad axial ribs, which on early whorls are best developed at periphery; in later whorls the hump is a little anterior to the middle . . . Spaces separating the ribs are broad and shallow with microscopic incremental lines and faint spiral striations . . . Base moderately long, marked by feeble spiral threads which increase in length from periphery and develop into five equal and almost equally spaced cords on the columella. Outer lip with notch anterior to the summit . . . backed by a heavy varix. Anterior channel profound; . . . columellar callus extends up on parietal wall.

*C. thea* differs from this species in being of uniform chocolate-brown, with axial ribs shorter and broader, the knobs more pronounced.<sup>334</sup>

Dredged in five fathoms off Sanibel Island, Florida.

***Cerodrillia thea*<sup>335</sup> Dall**

Pl. 38, fig. 261

Alt., 15 mm. Shell fusiform, surface waxy. Color of strong tea, thin epidermis; eight convex whorls crossed by nine to eleven varices, strongest at periphery of whorls; faint spiral threads at base of body whorl; sutures distinct, aperture oval, more than half length of body whorl; outer lip curved forward, deep subsutural notch, shallow notches near base; short, straight anterior canal; interior of aperture dark-colored, polished; columella with narrow callus; brown corneous operculum.

From littoral zone to 15 fathoms. Fairly common about sand bars of inside waters.

**Subgenus LISSODRILLIA Bartsch and Rehder, 1939*****Cerodrillia schroederi*<sup>336</sup> Bartsch and Rehder**

Pl. 38, fig. 262

Alt., 5 mm. An unusually large specimen has an altitude of

<sup>334</sup> Bartsch and Rehder: Proc. U.S. National Museum, vol. 87, No. 3070.

Description given is condensed from the original.

<sup>335</sup> "Colored like tea leaves that have been steeped," Dall.

<sup>336</sup> Dedicated to Lt. Seaton Schroeder.



7.8; greatest diam., 22 mm. Shell small, turreted, elongate, waxy opaque-white.

Postnuclear whorls appressed at the summit, slightly rounded, marked by very slightly retractively curved, broad, rounded axial ribs, which are as broad as the spaces that separate them. Of these ribs ten occur on the first, eleven on the second, twelve on the third, and on the last two-thirds of a turn these become quite obsolete . . . They pass over the periphery and evanesce at the insertion of the columella. The ribs and intercostal spaces are marked by scarcely perceptible lines of growth. Base moderately long, marked by feeble continuations of axial ribs and inconspicuous spiral striations. Columella without spiral cords. Aperture elongate-oval, decidedly channeled anteriorly; outer lip with a profound sinus immediately below the summit and a weak stromboid notch anteriorly; inner lip covered with a heavy callus which extends over the parietal wall.<sup>337</sup>

Dredged on sandy bottoms in five to seven fathoms off Sanibel and Captiva islands, Florida.

Genus **MONILISPIRA** Bartsch and Rehder, 1939

**Monilispira leucocyma**<sup>338</sup> Dall

Pl. 38, fig. 263

Alt., 14; greatest diam., 4.75 mm. Shell chocolate-brown, prominent nodules cream-colored; apex light brown; elongate-turreted, about 10 whorls; first two nuclear whorls smooth, third obscurely ribbed; postnuclear whorls with a subsutural nodulose spiral cord and a duplex nodulous cord at periphery of whorls; the interspace concave with fine spiral striations. Below the duplex spiral of body whorl are about five nodulose spiral cords and numerous spiral threads. Fine spiral striation in interspaces; aperture elongate-oval, outer lip varicosely thickened in adult, posterior sinus moderately broad and deep, situated in concave subsutural space; anterior canal short, straight; columella straight, smooth callus; operculum acute-ovate, apical nucleus.

From the littoral zone to six fathoms. Not uncommon in colonies, about sand bars of inside waters.

**Monilispira monilis** Bartsch and Rehder

Pl. 38, fig. 264

Alt., 13; max. diam., 5 mm.

Shell elongate-turreted, chestnut-brown except for the tubercules, which are pale yellow, the interior of the aperture reflecting the color-

<sup>337</sup> Bartsch and Rehder: Proc. U.S. National Museum, vol. 87, No. 3070.

<sup>338</sup> Lat., *monile*, necklace; *spira*, a coil, twist; Gr., *leucos*, white; *kyma*, wool.

tion of the outside. The first two nuclear whorls are smooth, followed by a turn in which there are moderately strong, retractively curved axial riblets, which are about as wide as the spaces that separate them; following this is the postnuclear sculpture. Postnuclear whorls with a spiral cord immediately below the summit and a broad tuberculated cord immediately above the suture. The latter is marked by a secondary cord, which coincides with the crest of the tubercules and a little heavier one immediately anterior to the major portion of the tubercules. This on the early turn falls into the suture, but on the last whorl is slightly posterior to it. Of the tubercules twelve are present on the first of the postnuclear turns, ten on the second, third, and fourth, eleven on the fifth and sixth, and six on the last half of the last turn. In addition to the above sculpture, the entire spire and base are marked by numerous, closely spaced, spiral threads, which in combination with the slightly weaker incremental lines lend to the surface, under high magnification, a somewhat fenestrated aspect. Base moderately long, marked by three tuberculated spiral cords. Columella stubby, marked by nine spiral cords, which range from as strong as the last basal to mere threads at the tip of the columella; aperture irregularly pyriform, decidedly channeled anteriorly; outer lip with a very deep sinus a little below the summit whose edge is reflected. Posterior to the sinus there is a heavy hump, anterior to the sinus the outer lip is protracted into a clawlike element, which is rendered sinuous by the external sculpture; inner lip reflected over the columella as a very heavy callus, which extends up on the parietal wall.<sup>339</sup>

Dredged in four to seven fathoms off Sanibel Island, Florida. Found on living *Atrina* stranded on beach after a blow.

Genus **MANGILIA** Risso, 1826

*Mangilia plicosa*<sup>340</sup> (C. B. Adams)

Pl. 38, fig. 265

Alt., 6-8 mm., spire about half of altitude. Shell dark amber-brown under dull grayish epidermis; six or seven whorls, sutures distinct; 11 or 12 strong axial ribs rendered nodulous by numerous revolving ridges; aperture semilunar; outer lip thickened, with posterior varix in adult; posterior sinus shallow, rounded, subsutural; interior dark; anterior canal short; no operculum.

In shallow water. Usually on muddy and grassy bottom.

An adult kept in plunger jar laid one egg-capsule. Others were found on severed siphon of a lamellibranch which agreed with those obtained from mollusc in jar and with the hatched young.

Egg-capsules are smooth and transparent, lens-shaped, attached by flat under surface; upper surface rounded, with thin central area where larvae emerge. Diameter of capsule in jar 30.1 to 33 mm., height 0.32 mm., diam. of egg-capsule on siphon 18.5 to 31 mm., height 1.76 mm. Newly laid eggs about 0.16 mm. diam. About 60 eggs in aquarium capsule, less in capsule from siphon, which were further advanced.—Marie Lebour.

<sup>339</sup> Bartsch and Rehder: Proc. U.S. National Museum, vol. 87, No. 3070.

<sup>340</sup> Dedicated to the naturalist G. Mangili; Lat., *plicare*, to fold.

Similar egg capsules have been found on siphons of *Corbula* at Sanibel.

Genus **KURTZIELLA** Dall, 1918

**Kurtziella atrostyla**<sup>341</sup> (Dall)

Pl. 38, fig. 266

Alt., 7; spire, 4.1 mm. Shell opaque, milky white with brown stain on columella, brown sutural band, often brown coloration on outer lip, occasional brown specimens; six whorls, keeled at shoulder; eight or ten axial ribs and fine spiral striations; aperture and short anterior canal slightly oblique; outer lip with shallow, rounded posterior notch; no operculum.

A littoral species. Occasionally taken at two to four fathoms.

**Kurtziella cerinella**<sup>342</sup> (Dall)

Pl. 38, fig. 267

Alt., 10.5; spire, 5.5 mm. Shell slender; spire elongate, tapering; waxy-cream color or yellowish; thin epidermis; seven or eight whorls, shoulder sloping to acute keel; sutures distinct, wavy; six or seven axial ribs; spiral sculpture of fine threads over entire surface; aperture almost semilunar; outer lip with shallow notch at angle of whorl; anterior canal extremely short; no operculum.

Most common and abundant turrid of Florida's West Coast. Shallow water to moderate depths on sandy bottom. Shells often studded with egg capsules of some small gasteropod mollusk—probably *Olivella pusilla*.

**Kurtziella perryae** Bartsch and Rehder

Pl. 38, fig. 268

Shell minute, elongate-turreted, milk-white with a creamy tinge. The first nuclear turn is well rounded, smooth. This is followed by a turn marked by closely spaced axial riblets and four spiral cords, the latter rendering the axial riblets roundly nodulose at their junction. The third cord is a little anterior to the middle and forms an angle. Postnuclear whorls appressed at the summit, marked by very strong axial ribs, which become enfeebled toward the summit and extend anteriorly on the last whorl to the columella. These ribs are more strongly pronounced on the middle of the turns, which they angulate. Of these ribs, twelve occur on the first, eleven on the second, ten on the third, fourth, and fifth, and five on the last half of the last turn. The ribs are only about half as wide as the spaces that separate them. In addition to these strong ribs, slender, very regular, closely spaced axial threads are present, which are crossed by spiral threads of equal strength, the junctions of which produce slender

<sup>341</sup> Lat., *atro*, from *ater*, black; Gr., *stylos*, a pillar.

<sup>342</sup> Lat., dim. of *cerinus*, wax-colored.

rounded nodules, that give to the entire surface of the shell a decidedly granulose effect. This type of sculpture also characterizes the base where the spirals are a little more distantly spaced and the nodulation less pronounced. Columella short and stubby, marked by rather rough oblique lines. Aperture oval, strongly channeled anteriorly with a deep sinus immediately below the summit, whose outer edge is somewhat thickened and reflected. Anterior to the sinus the outer lip is produced into a clawlike element. Inner lip appressed to the columella as a callus extending over the parietal wall.<sup>343</sup>

Sandbars in shallow water.

Genus **STELLATOMA** Bartsch and Rehder, 1939

**Stellatoma**<sup>344</sup> *stellata* (Stearns)

Pl. 38, fig. 268A

Alt., 7 mm., spire a little less than half of altitude. Shell elongate, ovate, turreted; color yellowish, usually banded about sutures and body whorl and tinted about outer lip and columella with violet-brown; about six whorls; postnuclear whorls with straight shoulder sloping to angled keel, convex below, sutures distinct; about 11 axial ribs extending to base of body whorl, spiral threads below and fine spiral striations in intercostal spaces; aperture semioval; anterior canal extremely short; outer lip thickened, with posterior varix and a small denticle at anterior angle of the shallow, sub-sutural posterior sinus; columella with one obscure internal fold.

Sandy station from shallow water to three fathoms.

Genus **PYRGOCYTHARA** Woodring, 1928

**Pyrgocythara**<sup>345</sup> *hemphilli* Bartsch and Rehder

Pl. 38, fig. 269

Shell small, elongate-ovate, varying in ground color from chestnut-brown to wax yellow, usually with a pale zone at the angle of the shoulder. The outer lip and base of the columella may be orange or dark purplish orange. Nuclear whorls slender, the first 1.5 smooth, succeeded by about two-tenths of a turn that shows slender, retractively curved, axial riblets, which in turn are followed by the postnuclear sculpture. Postnuclear whorls moderately well rounded, appressed at the summit. The postnuclear whorls are marked by very strong, sinuous axial ribs, which taper at the summit and evanesce on the columella. Of these ribs 10 occur on the first and second, 9 on the third and fourth, 10 on the fifth, and 9 on the last. In addition to the axial ribs, the entire surface of the shell is marked by microscopic incremental lines. The spiral sculpture consists of a low, rounded, obsolete keel, which occupies the middle of the turns on the first four whorls but falls a little posterior to this on the rest of the shell. This produces a decided shoulder on the whorls.

<sup>343</sup> Bartsch and Rehder: Proc. U.S. National Museum, vol. 87, No. 3070.

<sup>344</sup> Lat., *stella*, star; Gr., *tomos* section.

<sup>345</sup> Gr., *pyrgos*, tower.

Anterior to the shoulder three ill-defined spiral cords are present on all but the last two whorls, on which there are four, the penultimate having four, while on the last turn intercalated cords appear between these. Base rather long, marked by the continuation of the axial ribs, which become slightly enfeebled anteriorly and the same type of sculpture as that characterizing the shell anterior to the angle. Columella stout, about as long as the base, marked by obliquely slanting, closely approximated, spiral cords, which vary in size and spacing. Aperture narrowly auriculate, decidedly channeled anteriorly and posteriorly. The anterior channel is deep and well rounded and is situated immediately below the summit. The lip posterior to the sinus is somewhat thickened. Anterior to the sinus the lip is much thickened but tapers to an edge and is slightly protracted. The inside of the outer lip immediately anterior to the channel bears a decided denticle. The inner lip is appressed to the columella as a small callus and thickened on the parietal wall.<sup>346</sup>

Genus **CRASSISPIRA** Swainson, 1840

**Crassispira**<sup>347</sup> **tampaensis** Bartsch and Rehder

Pl. 38, fig. 270

Alt., 22; max. diam., 7.3 mm. Ten whorls.

Shell elongate-turreted, chestnut-brown; interior of the aperture livid. The first nuclear whorl is well rounded, smooth, succeeded by a fraction of a turn in which faint, closely spaced, retractorily curved, axial riblets are present, which in turn merges into the postnuclear sculpture. Postnuclear whorls rendered somewhat shouldered at the summit by a strong spiral cord, which is followed anteriorly by a broad siphonal channel, anterior to which the whorls are marked by strong, somewhat sigmoid, axial ribs extending to the insertion of the columella. These ribs are about half as wide as the spaces that separate them; of these, 19 are present on the last turn and 17 on the antipenultimate, the early whorls being eroded in the type. In addition to the axial ribs, the whorls are marked by fine incremental lines, which are decidedly retractorily curved in the subsutural channel. The spiral sculpture consists of deeply incised lines, which leave the spaces between them as slightly elevated, flattened ribs; of these, 3 cross the axial ribs posterior to the suture. The base, which is moderately long, is similarly marked, and here the incised lines are broader and separate 4 well-differentiated cords, which render the axial ribs nodulose at their junction. Columella short and stout, marked by 9 spiral cords, which decrease in width from the insertion of the columella anteriorly. Aperture elongate pear-shaped; outer lip with a profound sinus a little below the summit; anterior to the sinus it is protracted into a clawlike element with a mere indication of stromboid notching anteriorly; the inner lip extends over the columella as a broad callus leaving a narrow umbilical chink at its anterior end. A callus extends over the parietal wall.<sup>348</sup>

**Crassispira tampaensis bartschi** L. Perry

Pl. 39, fig. 271

Alt., 24; max. diam., 7; spire, 13 mm. Shell elongate, turreted, chocolate- or mahogany-brown; nucleus and postnuclear whorl smooth; riblets and faint spiral striations begin on first half of

<sup>346</sup> Bartsch and Rehder: Proc. U.S. National Museum, vol. 87, No. 3070.

<sup>347</sup> Lat., *crassus*, thick, fat; *spira*, coil, twist.

<sup>348</sup> Bartsch and Rehder: Proc. U.S. National Museum, vol. 87, No. 3070.

following turn; succeeding whorls bear increasingly stronger ribs and spirals; 11 whorls, sutures distinct, wavy. A strong, undulating subsutural cord angulates summit of whorls above a wide concave sulcus; the sulcus shows one, two or three unequal spiral threads overlying retractively curved incremental lines. Below sulcus the axial ribs extend to suture below. Ribs and interspaces crossed by three elevated ridges separated by wider interspaces. On body whorl eight strong revolving ridges cross and nodulate the axial ribs; interspaces have fine spiral threads; nine revolving cords below, beginning at columella; aperture pyriform, dark within; outer lip with moderately deep notch in the subsutural sulcus; columella callus; anterior canal slightly oblique; operculum dark, shape of aperture, apical nucleus.

This subspecies differs from *C. tampaensis* in having definite spiral threads in the subsutural sulcus, one or two more axial ribs, more generally distributed spiral striation and the uniformly dark-colored aperture.

Dredged in four to seven fathoms, with *C. tampaensis*.

*Crassispira sanibelensis* Bartsch and Rehder

Pl. 39, fig. 272

Alt., 25.8; max. diam., 9.9 mm. Seven or eight whorls.

Shell elongate-turreted, brown, with the intercostal spaces flesh-colored, the edge of the aperture corresponding to the dark color outside, but the interior is livid. First nuclear whorl smooth, followed by a turn with rather closely spaced axial riblets and an indication of spiral threads with the possibility of nodules at their junction. Postnuclear whorls moderately rounded, appressed at the summit, marked by broad, low axial ribs, which terminate at the anterior extremity of the broad siphonal channel. These ribs are broader than the spaces that separate them. In addition there are numerous threadlike incremental lines. The spiral sculpture consists of heavy cords of which the first one is on the shoulder anterior to the summit. Two strong cords appear anterior to the sutural sinus on all but the last two of the remaining turns; on these, three cords are present that render the broad axial ribs nodulose, the nodules having their long axis parallel with the spiral sculpture. In addition to the coarser spiral sculpture, microscopic spiral lines are present on the entire surface. Base moderately long with a narrow umbilical chink at the tip, marked by four spiral cords, which slightly decrease in size anteriorly. Columella stout, stubby, with six heavy cords and several slender threads anterior to these. Aperture oval, decidedly channeled anteriorly with a deep sinus immediately anterior to the cord at the summit. Anterior to the sinus the outer lip is protracted into a clawlike element that bears a series of nodules corresponding to the cords on the outside; inner lip heavy and reflected over the columella. A callus extends over the parietal wall joining the heavy cord at the summit.<sup>349</sup>

<sup>349</sup> Bartsch and Rehder: Proc. U.S. National Museum, vol. 87, No. 3070.

Genus **GLYPHOTURRIS** Woodring, 1928**Glyphoturris rugirima**<sup>350</sup> (Dall)

Pl. 39, fig. 273

Alt., 8; spire, 4.5 mm. Shell small, turreted; white with brownish markings in revolving lines and about sutures; eight whorls; nucleus and postnuclear whorl smooth, next whorl rounded with narrow, sharp riblets and fine spiral threads. Succeeding whorls with strong, rounded axial ribs, sharply keeled at shoulder of whorls; eight ribs on body whorl extending to base of shell. Strong spiral cords and fine threads overlay axial ribs and extremely fine and closely placed grooves cross the revolving sculpture producing a fine granulation of the entire surface. The extreme delicacy of this sculpture is apparent only in living specimens. Aperture widest at middle, anterior canal short, well open, widest at base; outer lip with thick posterior varix, a low internal varix within; sinus broad, rounded; columella with one obscure oblique fold; no operculum.

Dredged in two to six fathoms. Occasionally found living on sandy bottoms of shallow bays.

Genus **RUBELLATOMA** Bartsch and Rehder, 1939**Rubellatoma diomedea**<sup>351</sup> Bartsch and Rehder

Pl. 39, fig. 274

Alt., 9.7; max. diam., 4.0 mm.

Shell elongate-turreted. Nuclear whorls bright chestnut-brown, the rest of the whorls with a broad brown band covering the posterior half of the whorls. There is a second broad band a little less wide immediately anterior to the periphery followed by a pale zone of almost equal width, while the tip is chestnut-brown. The interior of the aperture shows the exterior coloration. The first 1.5 nuclear whorls are smooth, the succeeding half turn is marked by slender, retractively curved, axial riblets followed by the postnuclear sculpture. Postnuclear whorls appressed at the summit, with a decided angle, the crest of which occupies the anterior fourth between the summit and suture. The whorls are marked by strong sinuous axial ribs, which attain their highest elevation at the angulation and taper gently toward the summit and columella where they evanesce. Of these ribs, 12 occur on the first postnuclear turn, 9 on the second, third and fourth, 10 on the fifth, and 7 on the last seven-tenths of a turn. The axial ribs are not quite so wide as the spaces that separate them. The entire surface of the shell is marked by numerous incremental lines and equally strong spiral striations, the combination of which gives to the surface a feebly fenestrated pattern. Base rather long, marked by the same sculpture as that which characterizes the spire. Columella short,

<sup>350</sup> Gr., *glyphein*, to carve; Lat., *turris*, tower; *ruga*, a wrinkle; *rima*, cleft, fissure.

<sup>351</sup> Lat., *rubellus*, reddish; *diomedea*, genus of bird albatross, collected by U.S. Bureau of Fisheries Steamer "Albatross".

stubby, marked by incremental lines and weak spiral threads. Aperture elongate-ovate, decidedly channeled anteriorly, with the posterior sinus shallow immediately below the summit. Outer lip somewhat thickened behind the edge, sharp at the edge, slightly protracted anteriorly at the notch and marked like the spire; the inner lip is appressed to the columella as a callus extending up on the parietal wall.<sup>352</sup>

#### Family CANCELLARIIDAE

This is a small family most of whose species are native to warm seas and moderate depths.

The shells are medium-sized, oval, with short spire, and plicate columella. No operculum.

#### Genus CANCELLARIA Lamarck, 1799

*Cancellaria reticulata*<sup>353</sup> (Linné)

Pl. 39, fig. 275

Alt., to 50 mm.; shell ovate, yellowish white irregularly banded and plaited with rusty-brown; thin epidermis; six whorls; spire short, apex acute, body whorl rounded, narrowed below; sutures distinct; strong reticulate sculpture of low, rounded, somewhat oblique longitudinal ribs and flattened, revolving bands; intersections more or less nodular; aperture lunate; a recurved notch or short canal at base; outer lip simple, sharply crenate within; columella with three folds revolving deeply into aperture, lower two oblique, upper nearly horizontal; columellar callus extended over body whorl; narrow umbilical groove at edge of callus.

Dredged in three to six fathoms. Common beach shell. Occasionally albino specimens.

*Cancellaria conradiana* Dall

Pl. 39, fig. 276

Alt., 25-30 mm. Shell more slenderly ovate with relatively higher spire than *C. reticulata*; white with scattered maculations of light brown; apex acute, nuclear whorls yellowish, glossy; spire terraced; reticulate sculpture clear and sharp; columella has three plications. One revolving band forms a sharp lamellar ridge above columella. Other characters typical.

Dredged in five to seven fathoms.

<sup>352</sup> Bartsch and Rehder: Proc. U.S. National Museum, vol. 87, No. 3070.

<sup>353</sup> Lat., *cancellare*, to make like a lattice; *reticulatus*, reticulate.



Order **PLEUROCOELA**<sup>354</sup>Family **ACTAEONIDAE**

The members of this family are small mollusks of world-wide distribution, having a long history in the geologic past. Most of the species are from deep water.

The shells are of small size, ovate, with short, elevated spire, large body whorl with the aperture produced and widened below. The columella has one oblique fold.

Genus **ACTAEON** Montfort, 1810

**Actaeon punctostriatus**<sup>355</sup> (C. B. Adams)

Pl. 39, fig. 277

Alt., 3-6 mm. Shell small, thin, white, or faint rosy-brown, thin epidermis; spire elevated; nucleus a little tilted from vertical axis; four rather convex whorls; body whorl large, sutures deeply channeled. Sculpture of one or more revolving, subsutural grooves, body whorl smooth below suture with revolving, incised, punctate striations over basal half. Aperture about half length of shell, wide and produced at base; columella with one strong oblique fold; operculum corneous.

From one to sixty-three fathoms.

Family **ACTEOCINIDAE**

This is a family of small mollusks native to warm seas.

The shells are small, cylindrical or fusiform and characterized by elevated spire with mammillar nucleus, channeled sutures, and plicate columella.

Genus **ACTEOCINA** Gray, 1847

**Acteocina canaliculata**<sup>356</sup> (Say)

Pl. 39, fig. 278

Alt., 3.5 mm. Shell small, cylindrical, thin, white, translucent; four or five whorls, sutures deeply channeled; spire depressed, apex mammillar, deflected from vertical axis; body whorl large; aperture long, narrow, widened and slightly produced at base; outer lip arched forward; columella with strong, oblique basal fold; no operculum.

<sup>354</sup> Gr., *pleura*, rib, side; *koilé*, hollow.

<sup>355</sup> Gr., *Aktaion*, a huntsman; Lat., *punctum*, point; *striatus*, striated

<sup>356</sup> Lat., *canaliculatus*, channeled.

Family SCAPHANDRIDAE<sup>357</sup>

Distribution of the species of this family is through a wide geographic and bathymetric range. They are small and medium-sized mollusks with shells of variable forms.

Genus *CYLICHNA* Lovén, 1847

Subgenus *CYLICHNELLA* Gabb, 1872

*Cylichna bidentata*<sup>358</sup> (d'Orbigny)

Pl. 39, fig. 279

Alt., 2.6; diam., 1.4 mm. Shell minute, cylindrical, smooth, white, shining; spire depressed, concealed; body whorl narrowed above and below; aperture narrow, widened and produced below, outer lip sharp, arched forward; columella short, one oblique fold at base, a nodular thickening below.

Near low water mark.

## Family BULLIDAE

This family is represented by species native to all warm seas and adapted to a considerable range in depth. The animals are carnivorous and some members of the group are said to ingest their prey alive and whole.

The shells are of small to medium size, oblong-cylindrical, spire involute, apex perforate; aperture longer than body whorl, much expanded at base; outer lip thin, sharp; columella arcuate, with produced white callus; no plications.

Genus *BULLA* Linné, 1758

*Bulla occidentalis*<sup>359</sup> A. Adams

Pl. 39, fig. 280

Alt., 20-25 mm. Shell smooth, with microscopic striations; oblong-cylindrical; apex deeply perforate; variable in size, thickness; mottled and obscurely banded with brown on light background, thin, delicate epidermis; aperture narrowed near periphery of body whorl, produced and expanded below.

Sandy stations in shallow water.

<sup>357</sup> Gr., *scapha*, boat, boat-shaped.

<sup>358</sup> Gr., *kylix*, a drinking cup; Lat., *bidentatus*, with two teeth.

<sup>359</sup> Lat., *bulla*, bubble; *occidentalis*, of the west.

**Bulla striata**<sup>360</sup> Bruguière

Pl. 39, fig. 281

Alt., 20-30 mm. Shell with general characters of *B. occidentalis*, apical perforation slightly larger; spirally striate within; narrow spiral grooves about base, sometimes a few at shoulder of body whorl; columellar callus faintly brown-stained.

Sandy stations in shallow water.

**Bulla amygdala**<sup>361</sup> Dillwyn

Pl. 39, fig. 282

Alt., to 40 mm. Shell smooth, solid, oblong-cylindrical, narrowed at vertex, mottled and obscurely banded with purplish brown on light background, thin, rather dull epidermis; apical perforation large, spirally striate within; surface without spiral striation, sometimes a few impressed revolving lines at base and vertex. "Outer lip thick, heavily calloused where it rises from vertex; outer portion straight, not convex, base broadly rounded; columella arcuate, with heavy reflexed crescentic callus, the outer edge of which is well raised from the whorl throughout, leaving a chink behind it; parietal callus strong, white; interior lined with a white callus".<sup>362</sup>

Fresh shells have been found on beaches of Sanibel, Captiva and Bonita Beach, Florida.

## Family AKERIDAE

A family of widely distributed small mollusks usually found in shallow water of bays and estuaries.

The animals are carnivorous. The shells somewhat resemble those of *Bulla* in shape, but are thin and fragile; unicolored, white, pinkish, amber, or greenish.

Genus **HAMINOEA** Turton and Kingston, 1830

**Haminoea succinea**<sup>363</sup> (Conrad)

Pl. 39, fig. 283

Alt., 10 mm. Shell small, fragile, cylindrical, pale amber or white; spire involute, vertex with small deep umbilicus; body whorl widest at base; surface evenly striate with minute, wavy spiral lines; aperture long, narrow, expanded below; outer lip thin, sharp; columella arcuate, one weak fold above middle.

In shallow water on sandy bottoms.

<sup>360</sup> Lat., *striatus*, striated.

<sup>361</sup> Lat., *amygdala*, almond.

<sup>362</sup> Tryon, G. W. and Pilsbry, H. A.: Manual of Conchology.

<sup>363</sup> Lat., *hamus*, hook?; *succinum*, amber.

***Haminoea antillarum guadelapensis*** Sowerby

Pl. 39, fig. 284

Alt., to 18 mm. Shell thin, translucent, pale amber or greenish; thin epidermis; ovate-globose, slightly narrowed at vertex; spire involute, vertex imperforate; surface shows irregular growth lines, and almost microscopic, fine, close, revolving striations; aperture narrow above, widely expanded at base; outer lip thin, sharp, extended beyond vertex and recurved to join with a prolongation of the columellar callus; columella deeply arcuate with a small fold above middle.

Beyond low tide mark—often in tide pools or about the inlets of creeks and bayous.

Family **APLYSIIDAE**

The free swimming animals of this family bear little external resemblance to any gasteropod mollusk. The shell is wholly internal and consists of little more than a subtriangular, shelly plate.

Genus **TETHYS** Linné, 1758***Tethys*<sup>364</sup> *willeoxi*** Heilprin

Pl. 55, figs. 364a, b

Alt., 53 mm; breadth, 38 mm. Subtrigonal shell is thin and flexible, translucent, almost flat; inner layer extremely thin, with iridescent, horny, calcareous consistency; outer layer straw colored, slightly larger than inner layer. Apex is posterior and sharp, the anterior border rounded, shallow notch near the apex.

The shell is most difficult to extract from the body owing to its delicacy, having the consistency of wet paper when fresh and extreme brittleness when dry. Separating the swimming lobes, a sharp knife is needed to remove the body parts covering the shell which is nearly central and near the surface. The body can only be preserved in alcohol, and even then it soon loses its form and color.

This mollusk will best be recognized from the animal, locally called sea hare or sea pigeon; 100 to 150 mm. long; soft-bodied, head and neck quite extended but not distinctly separated from the body; mouth with corneous jaws, on the lower, forward end. Earlike, long

<sup>364</sup> Gr., *Tethys*, mythology, wife of Oceanus.

tentacles, with a short slit, on the upper, forward end, behind which are a pair of eyes, near the outer sides of the bases of the tentacles; behind these the rhinopores. Pleuropodia or "swimming lobes" are united behind, only where both join the heavy, elongate, oval foot, somewhat squared at the interior extremity, forming corners which can be turned inward for use as clasping processes. Also the entire extent of the lateral borders of the foot can be reflected over the plantar surface and used as clasps. They crawl with speed and facility, in snail fashion. They swim freely and rapidly by means of a winglike motion of these lobes, and can sustain themselves in a reversed position beneath the surface of the water. Body is patterned with a varied mixture of opaque sea-green, olive-gray and purple in irregular blotches and spots. When disturbed they exude large amounts of a beautiful deep purple fluid and escape in a smoke screen of this diffused fluid.

The eggs are laid in capsules contained in a greenish-white tangled mass of gelatinous stringlike threads, in the quiet, shallow water of the bays and coves, among the eel grass and sea weeds. The Chinese and many native South Sea races eat these eggs which are said to be quite palatable. Though the *Tethys* are vegetarian, they will sometimes eat their eggs, especially when in captivity.

#### Family OXYNOEIDAE

Intermediate between *Tectibranchiata* and *Ascoglossa*, nearer the latter. Few species are known and only one species of *Lobiger* has been found in the United States, in about six fathoms off Sanibel Island, Florida. Two specimens were dredged, entangled in a mass of bright green seaweed, *Caulerpa crassifolia* (C. Ag.) J. Ag.

Other species of *Oxynoe* and *Lobiger* from the Mediterranean, West Indies, and Indo-Pacific.

#### Genus LOBIGER Krohn, 1847

**Lobiger**<sup>365</sup> *pilsbryi* Schwengel

Pl. 55, fig. 365

Length, 12.5 mm.; width, 8.5 mm., with convexity of 5.5 mm. Shell oval, involute, thin and nearly transparent; surface closely and finely striate along lines of growth; aperture greatly expanded, columellar margin reflected; shell wholly external, mantle only nar-

<sup>365</sup> Gr., *lobos*, lobe. -

rowly covering the edges.

Animal elongate, not capable of being wholly contained in the shell; tentacles folded; eyes sessile; foot long; epipodial ridges well developed, giving rise to two winglike lobes on each side. Color of mollusk bright lettuce-green; body surface velvety, delicately reticulated and peppered with fine lines and dots of reddish purple, showing through the shell. Dorsal surface of the foot bears minute, pale, slightly elevated papillae. Posterior dorsal part of foot and body bear two lateral rows of pale brownish papillae, some large and pointed, others smaller, rounded and less elevated; the intervening body surface is slightly granular.

Four tentacles; an upper or superior pair of folded rhinophores, and a smaller, lower pair, or labial processes, less than half as long, contractile. Eyes are sessile, black, small, posterior to the base of the superior tentacles, at the junction of the anterior and middle thirds of a thin black line.

The four lateral parapodial lobes, two on either side, may be reflected over the sides of the shell or extended in lateral position, either synchronously or independently. They are deeply concave with elevated and reflected borders on dorsal side, smooth and gray-green within the upper concavity, granulose on exterior surface.

The foot is long, pointed or bluntly rounded, according to the mollusk's activity. Plantar surface smooth. The foot can be attenuated and lengthened, made short and broad, or infolded laterally to grasp a stem or blade of seaweed. The animal can elevate itself upon the posterior extremity of the foot to an almost vertical position and when in this attitude the head and anterior part of the body are moved rhythmically from side to side and in half circles through a fairly wide arc. The animal can also creep in a reversed position upon the under side of the surface film. It descends from this situation by strongly arching the body, releasing the anterior portion of the foot, swinging free from posterior tip of the foot and finally breaking away from its hold on the surface film by a strong contraction of the foot.

When disturbed, the creature may arch itself strongly upward, supported firmly upon the extreme anterior and posterior ends of

the body, and annoyance is often manifested by the secretion of great amounts of clear, colorless mucus. From this arched attitude the creature can assume an erect posture based either upon the anterior or the posterior extremity.

These observations were made on two animals kept in a small aquarium where one of them lived about five weeks, February 20 to March 26, 1941.

Suborder **BASOMMATOPHORA**<sup>366</sup>

Family **ELLOBIIDAE**

This is a family of amphibious mollusks. Most of its members can remain indefinitely out of water if sufficient moisture is otherwise available. Many of them are inhabitants of salt marshes and localities subject to periodic inundation of tidal water.

Genus **ELLOBIUM** Röding, 1798

**Ellobium pellucens**<sup>367</sup> Menke

Pl. 39, fig. 285

Alt., 15 mm. Shell oblong-oval, white with brownish epidermis; about four whorls; spire conic, elevated; body whorl large, sutures distinct; smooth, faint growth lines; aperture more than half length of shell, evenly rounded at base; columella short with two oblique folds.

Near high tide mark. Often about mangrove stumps and bunch grass.

Genus **MELAMPUS** Montfort, 1810

**Melampus**<sup>368</sup> *coffeus* (Linné)

Pl. 39, fig. 286

Alt., 18 mm. Shell ovate, smooth; about five whorls *enroulé*; spire low-conic; body whorl ample, sutures distinct; color brown or fawn, narrow cream-colored band at shoulder, two below, equidistant, lower about middle of body whorl; thin epidermis; aperture length of body whorl, widest below; outer lip thin, crenate within, recurved at base into columella and slightly thickened to form

<sup>366</sup> Gr., *basis*, base; *ommat*, eye; *pherein*, to bear. (Eyes at the base of the tentacles.)

<sup>367</sup> Gr., *ellobion*, lobe of the ear, earring; Lat., *pellucidus*, clear, bright.

<sup>368</sup> Gr., *melos*, black; *pous*, foot.

rim of umbilical depression; columella short with two white folds, upper heavy, stout, with shallow furrow on its lower aspect.

The shade and banded patterns of this shell are variable, the shoulder band appears constant, and there is often a light band near base.

Common in mud or tidal flats, often climb bushes and grasses. *Melampus* is eaten in large numbers by migratory ducks.

Genus **DETRACIA** Gray, 1840

**Detracia bullaoides**<sup>369</sup> (Montagu)

Pl. 53, fig. 359

Alt., 11 mm. Shell smooth, ovate, rather slender, about 10 whorls; spire one-third of altitude; color brown with variable pattern of obscure transverse bands and longitudinal wavy lines of cream color; epidermis dark shining-opaque; aperture almost length of body whorl, narrow above; outer lip thin, white crenations some distance from edge; columella with one strong basal fold, deep rounded notch above.

Near high water mark. Usually under wood or stone.

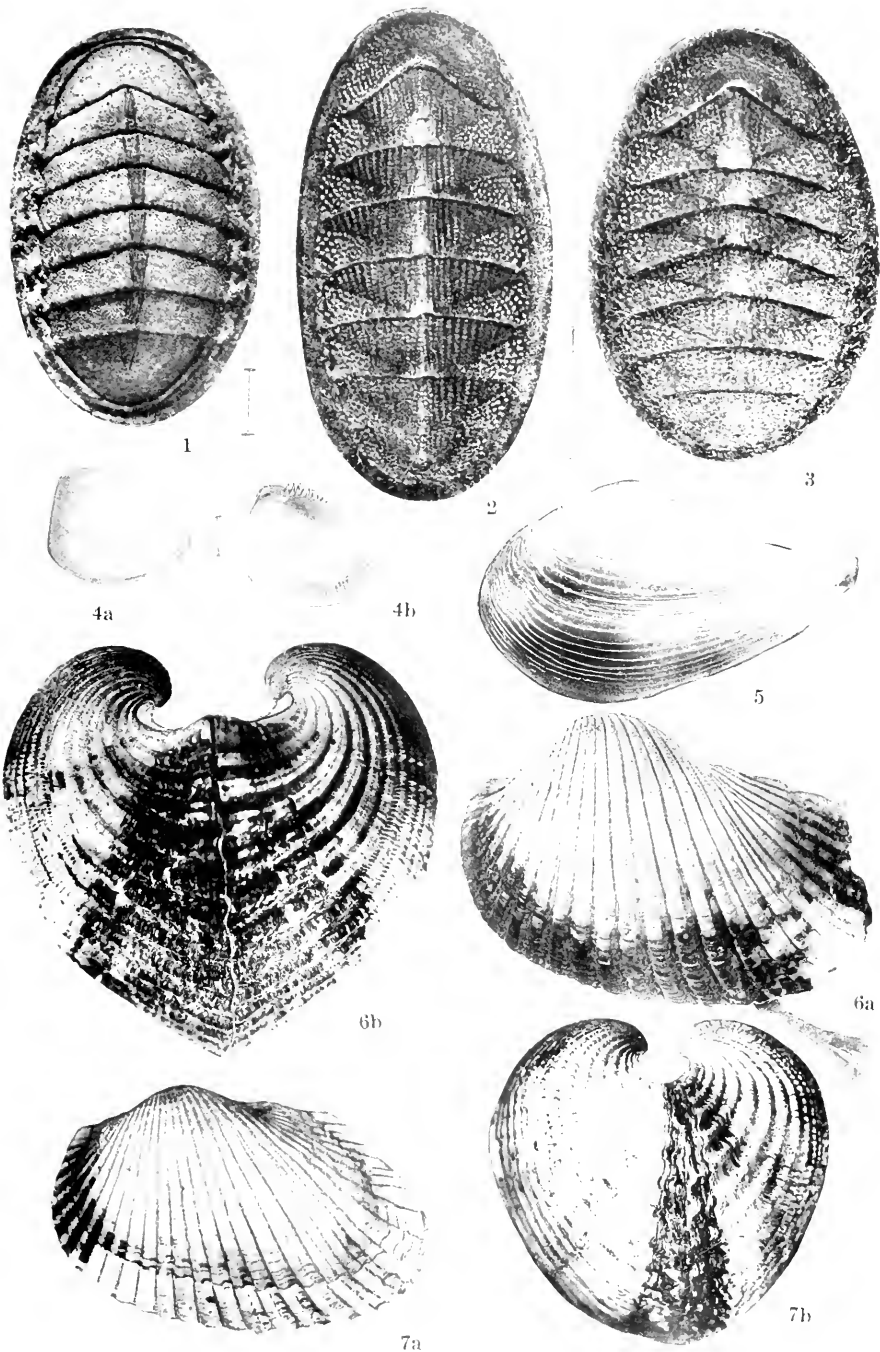
<sup>369</sup> Lat., *detrahere*, to take away; *bulla*, bubble; Gr., *eidōs*, form, shape.

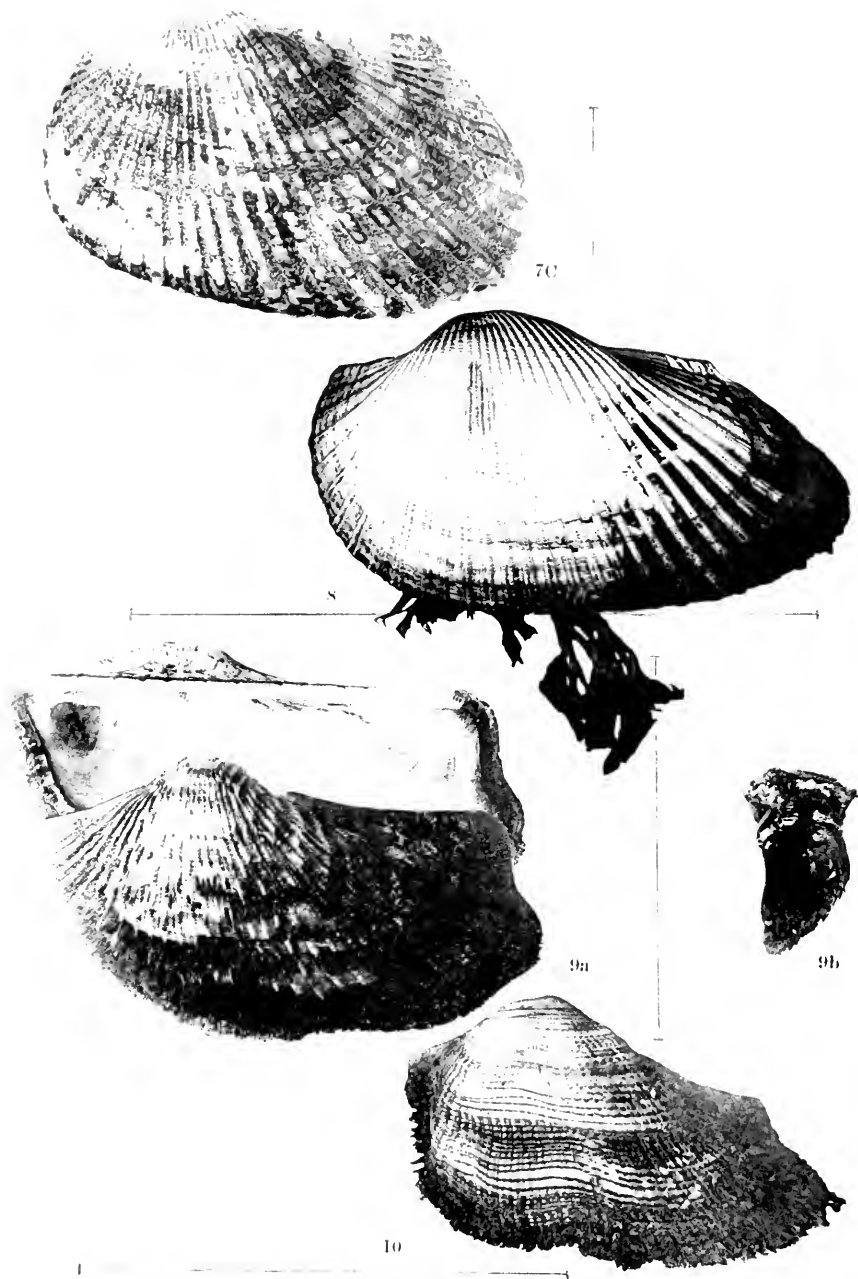


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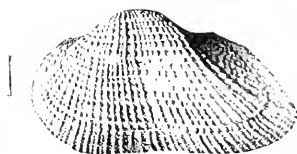
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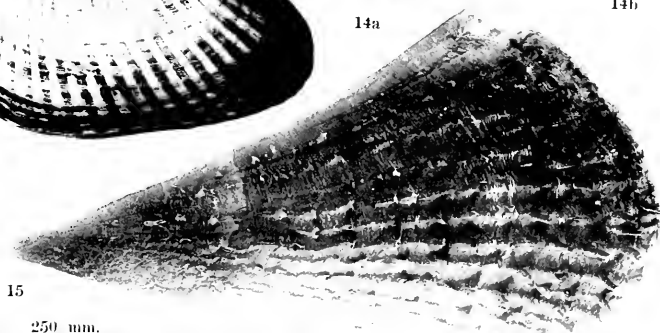
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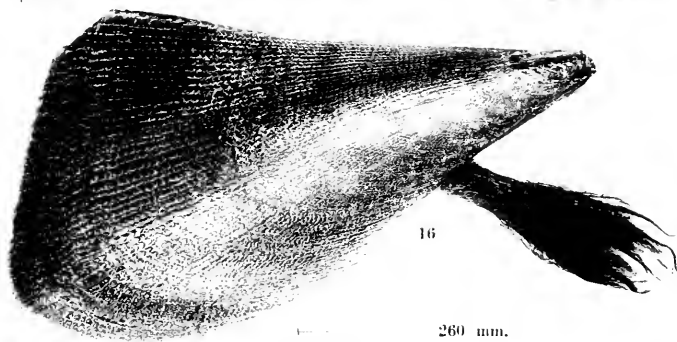


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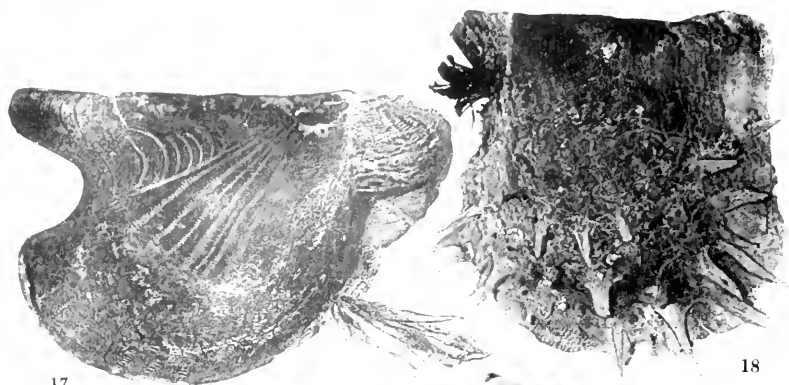
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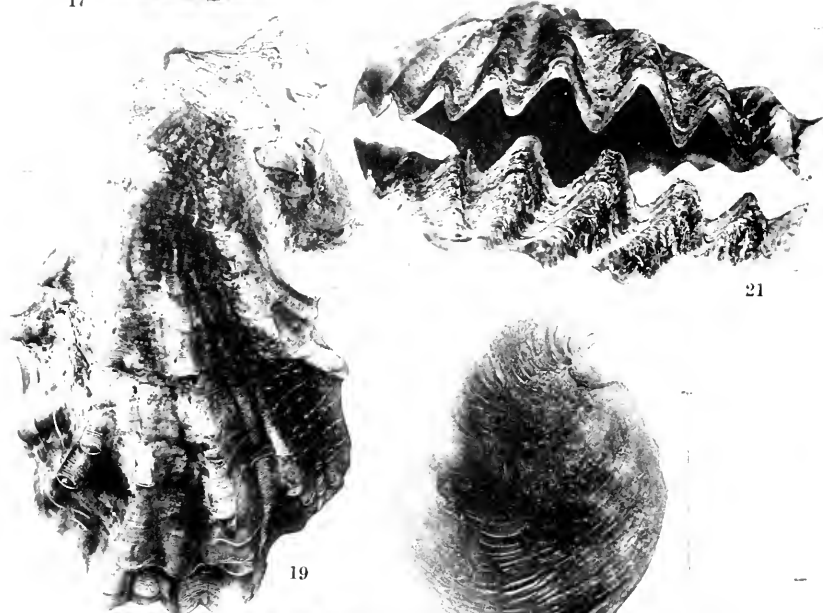
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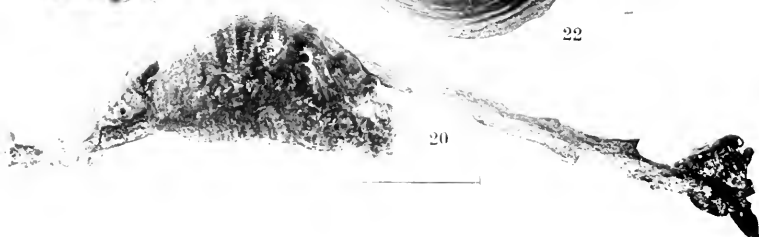


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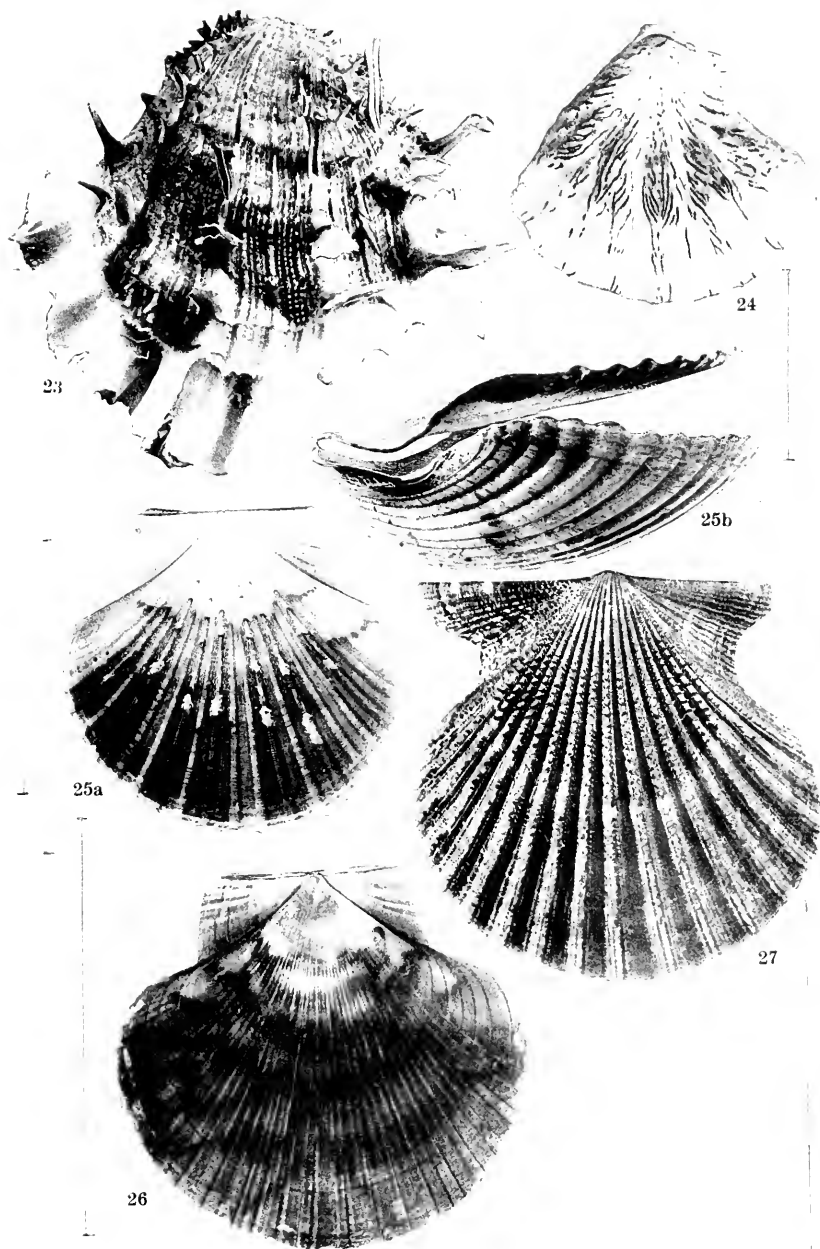


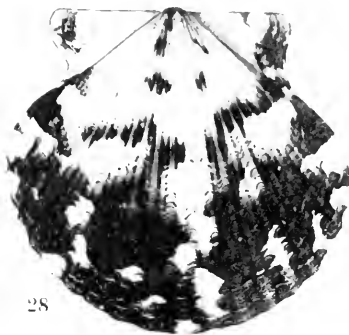
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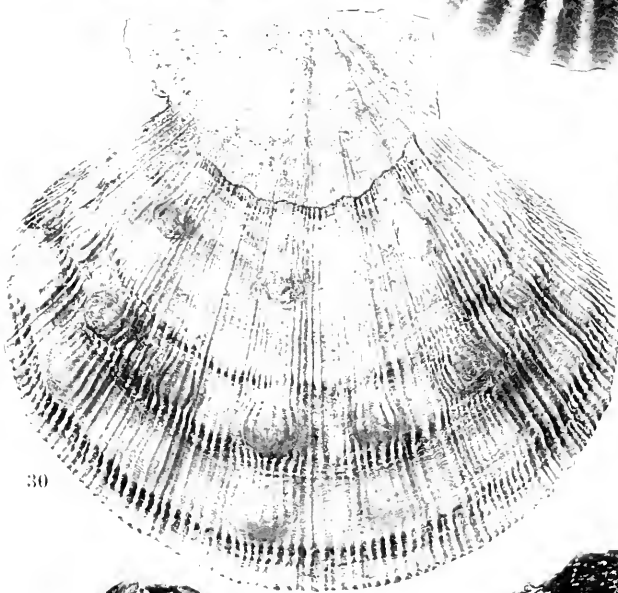




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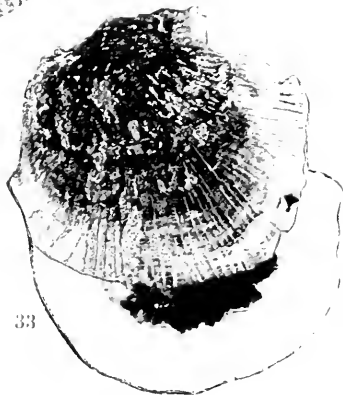
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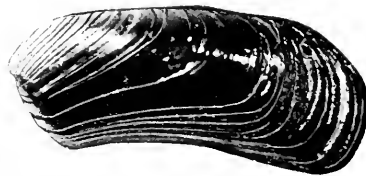
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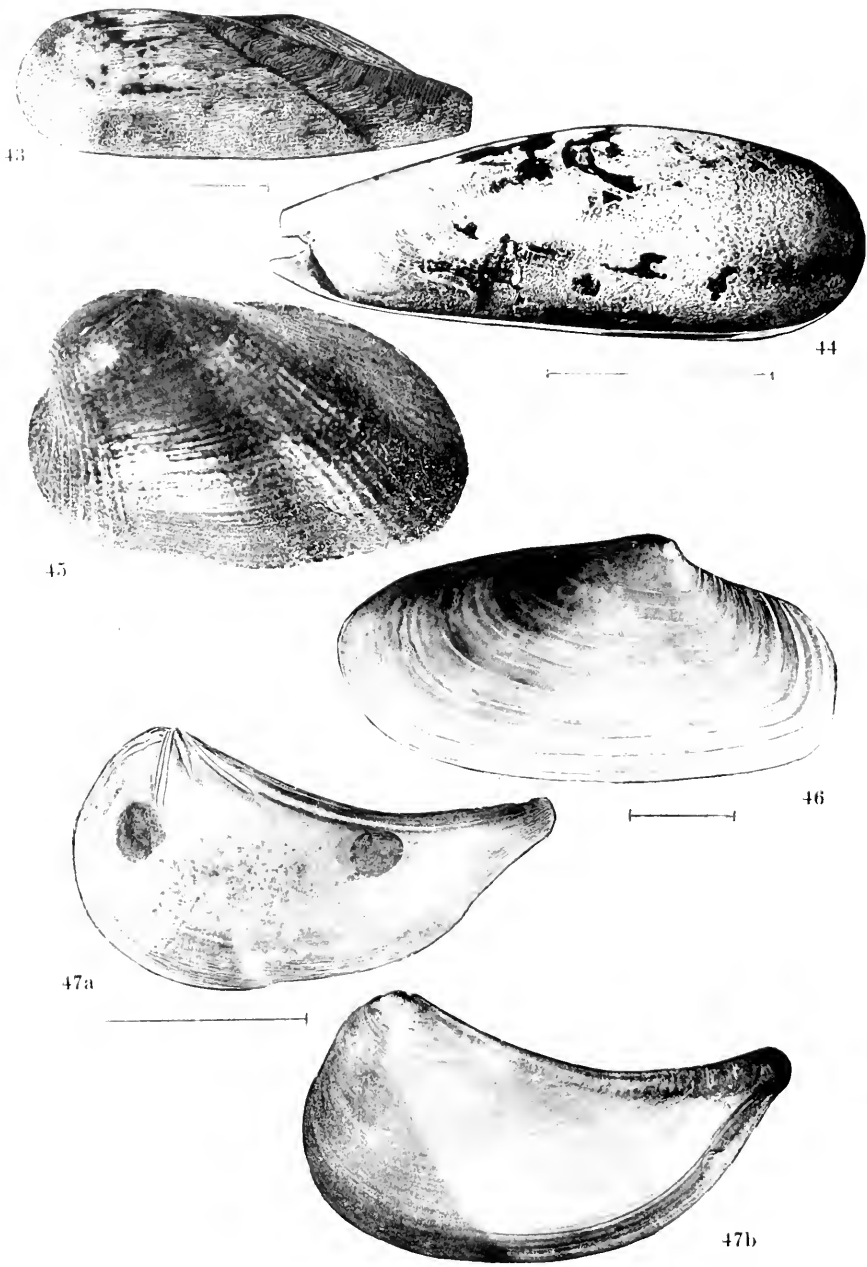
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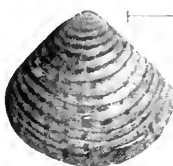
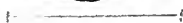
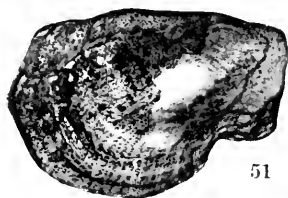
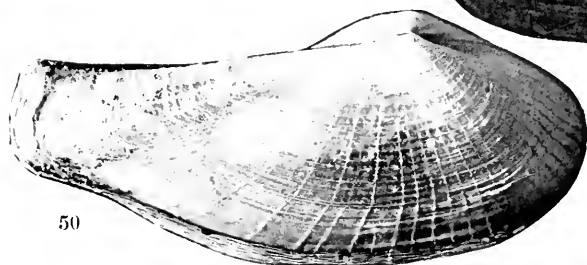
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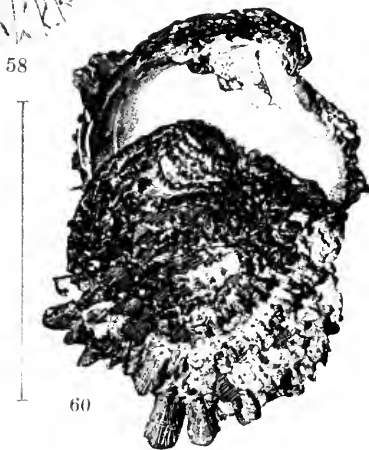
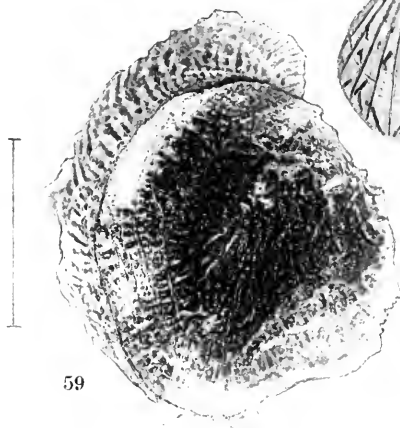
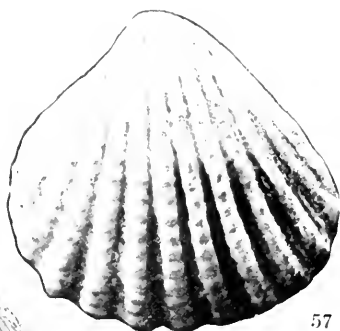
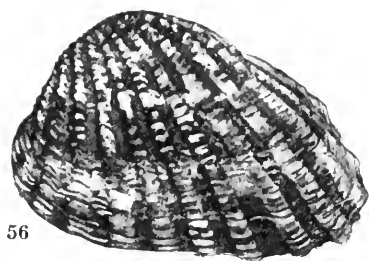
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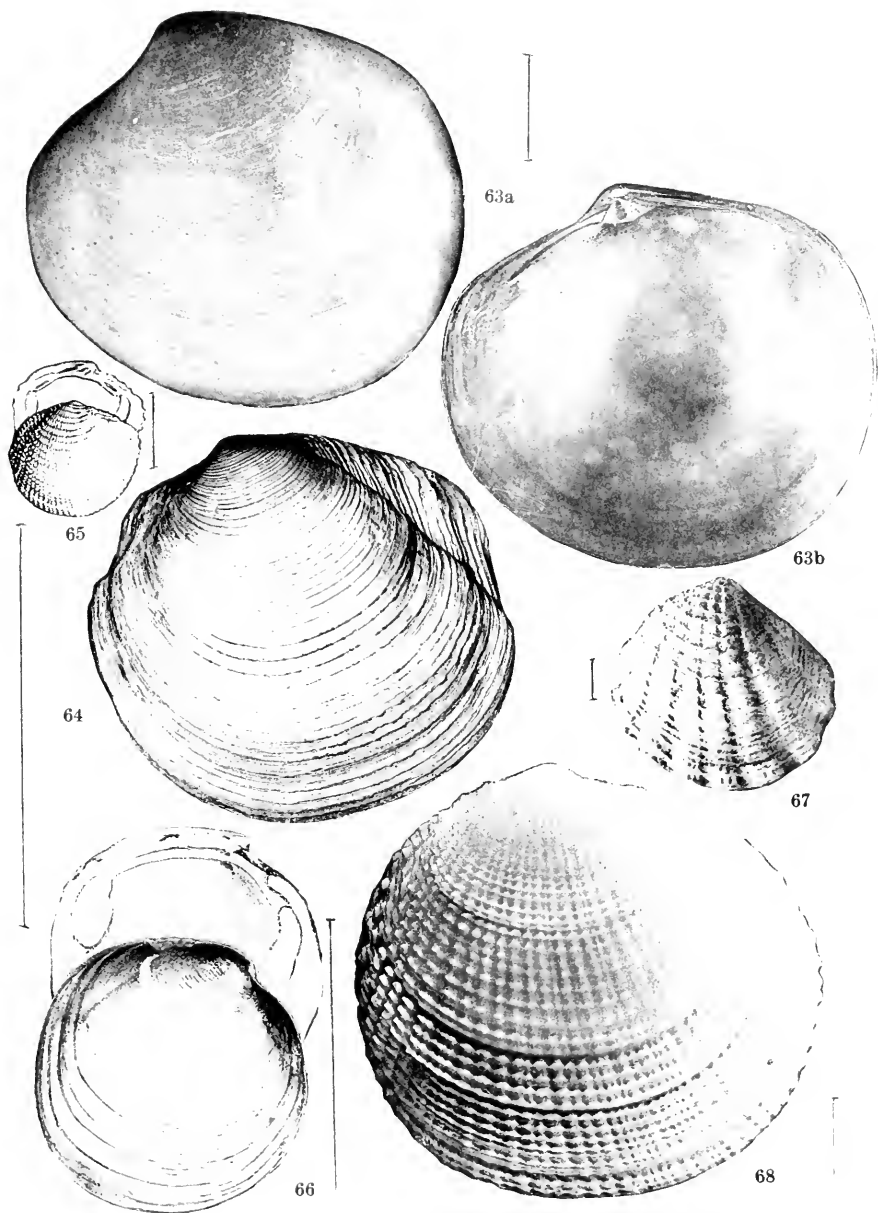


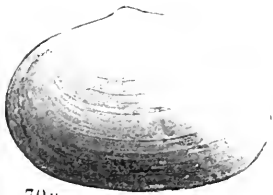
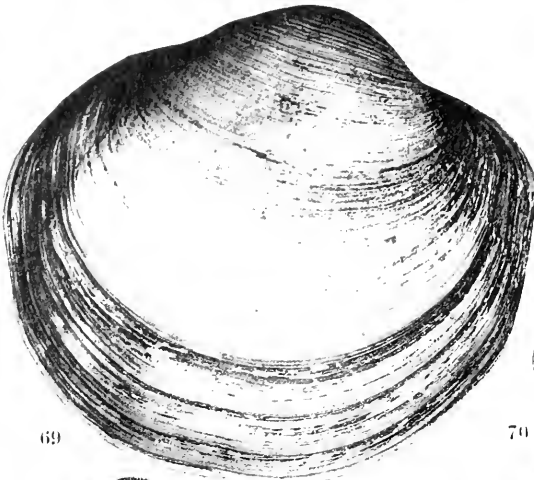
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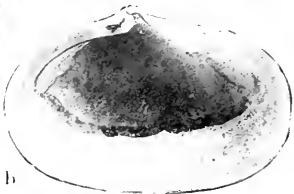
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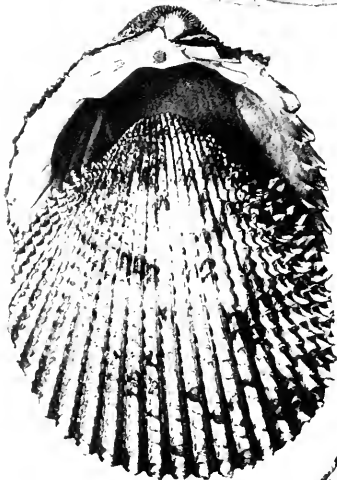




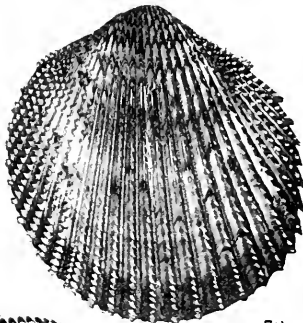
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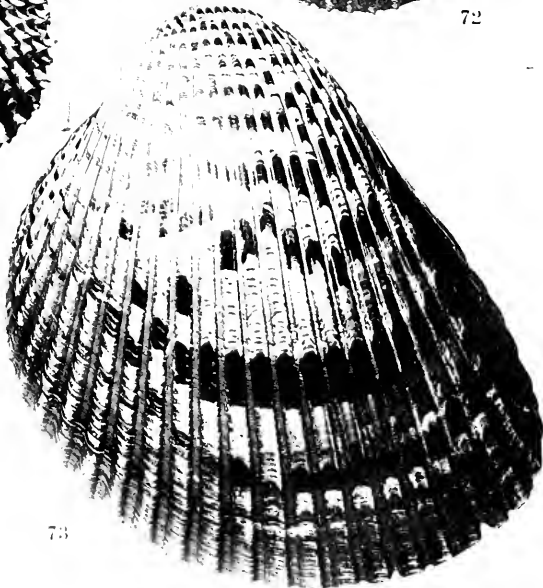


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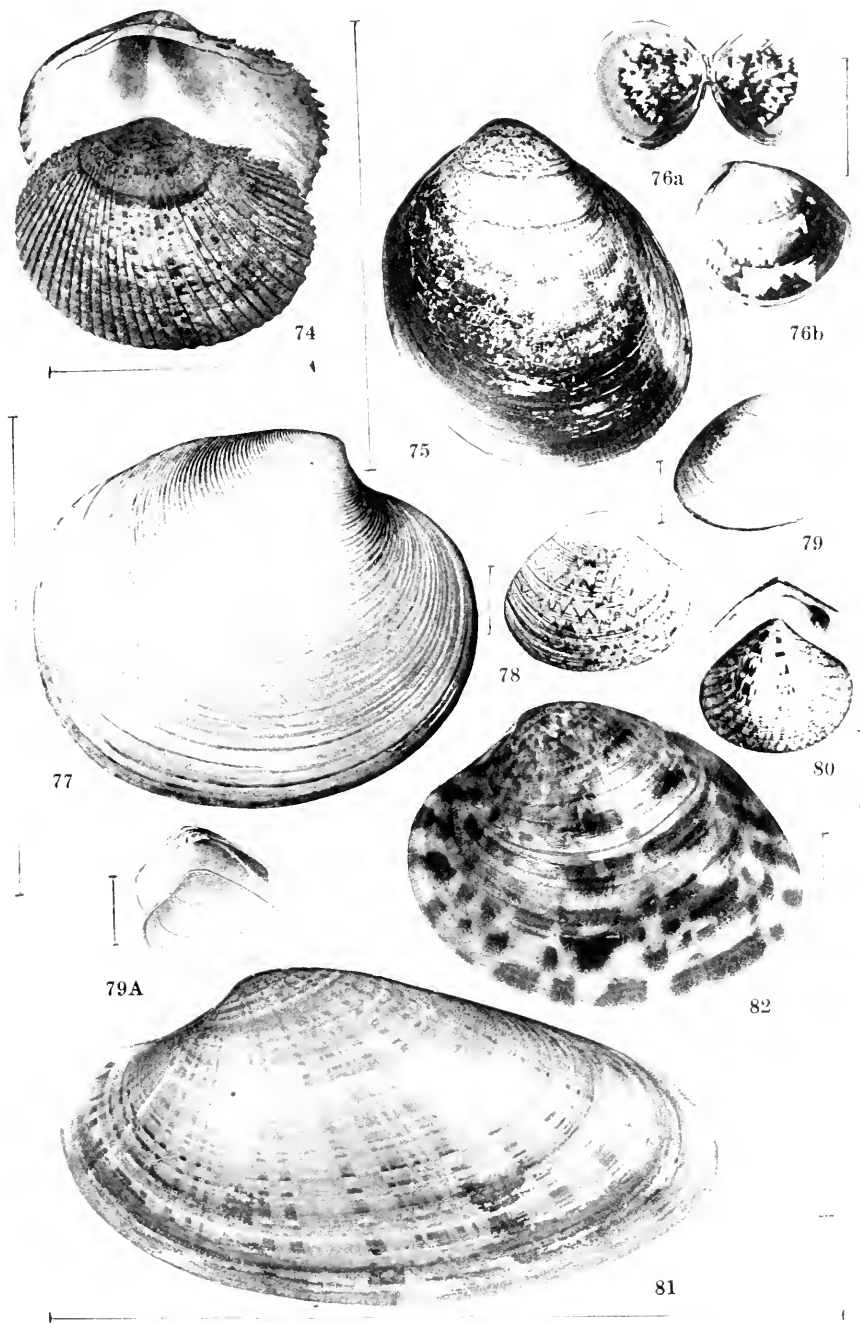


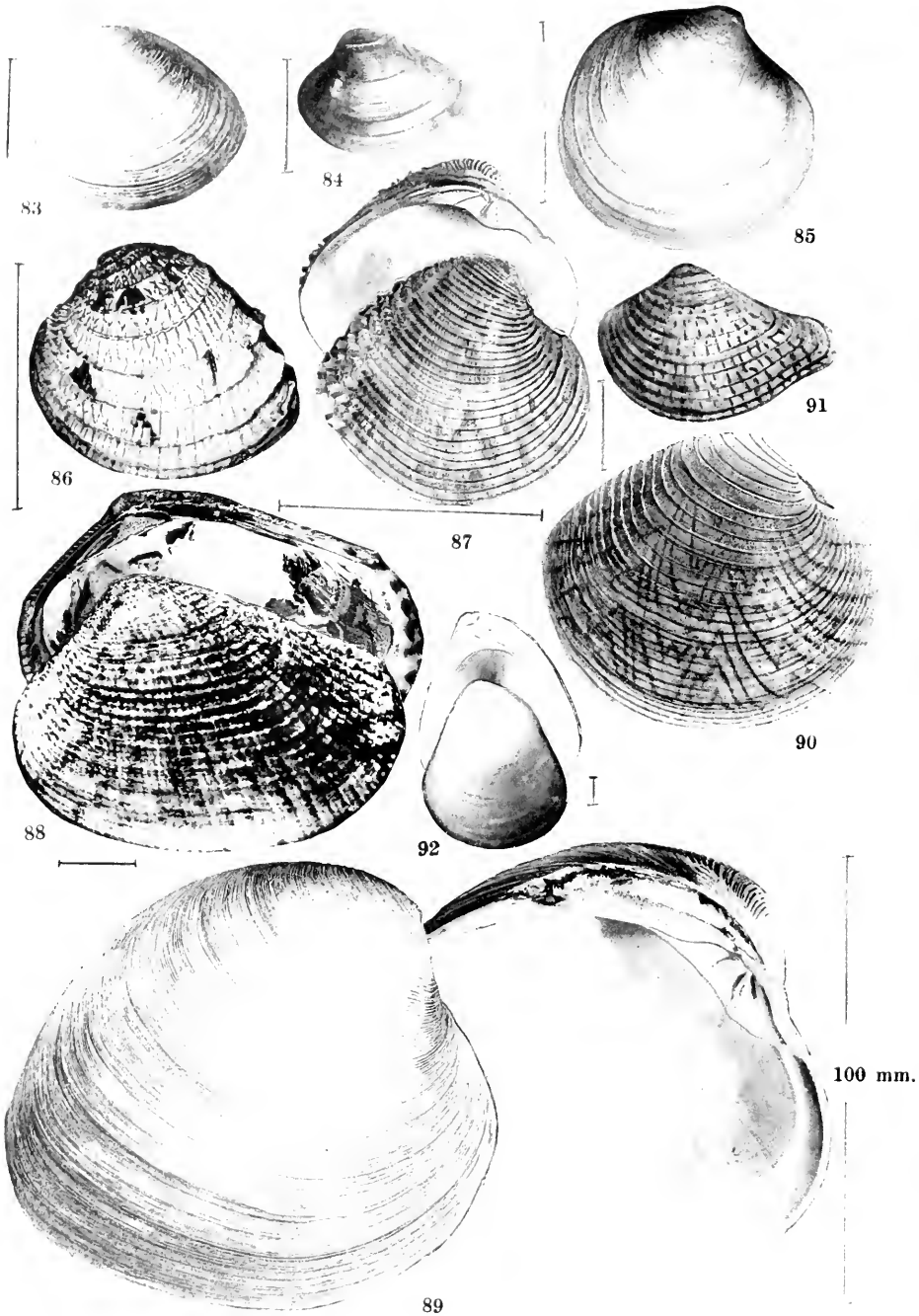
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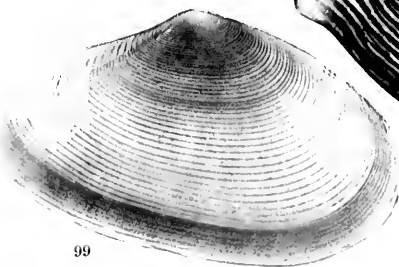
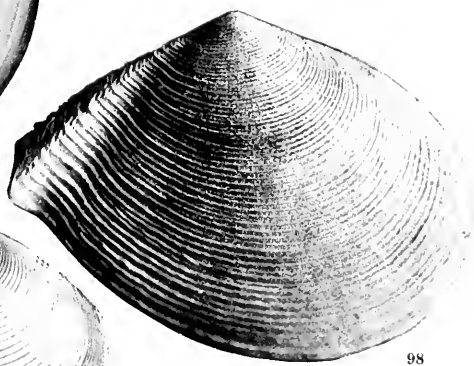
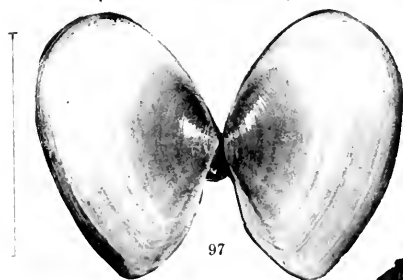
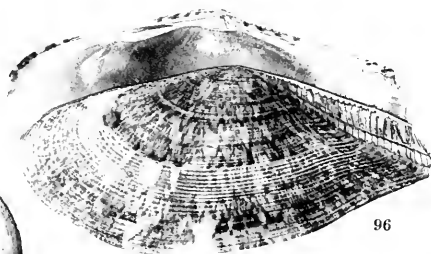
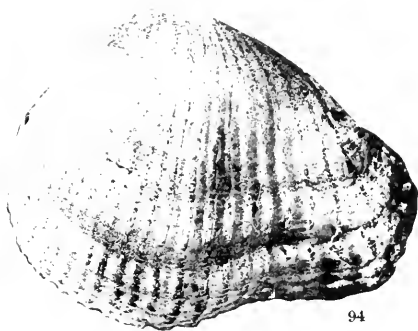
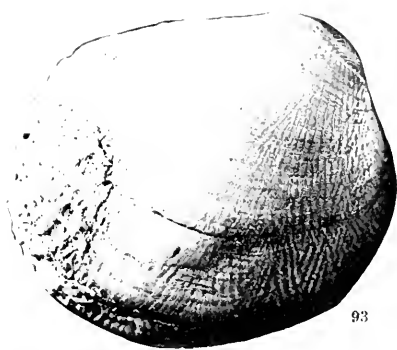


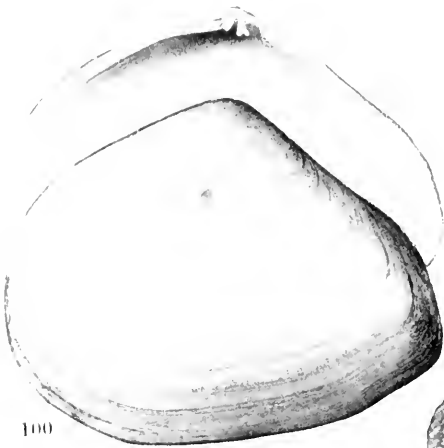
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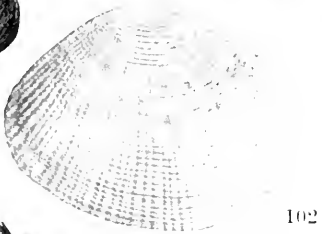




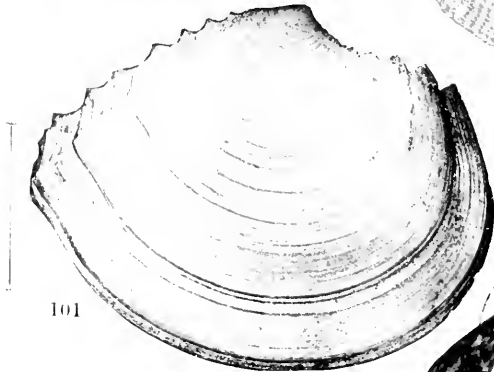
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100A



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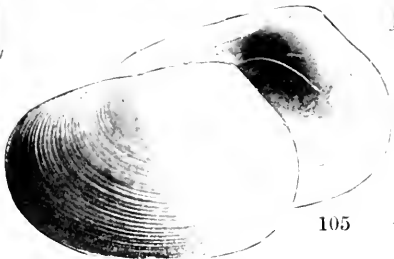
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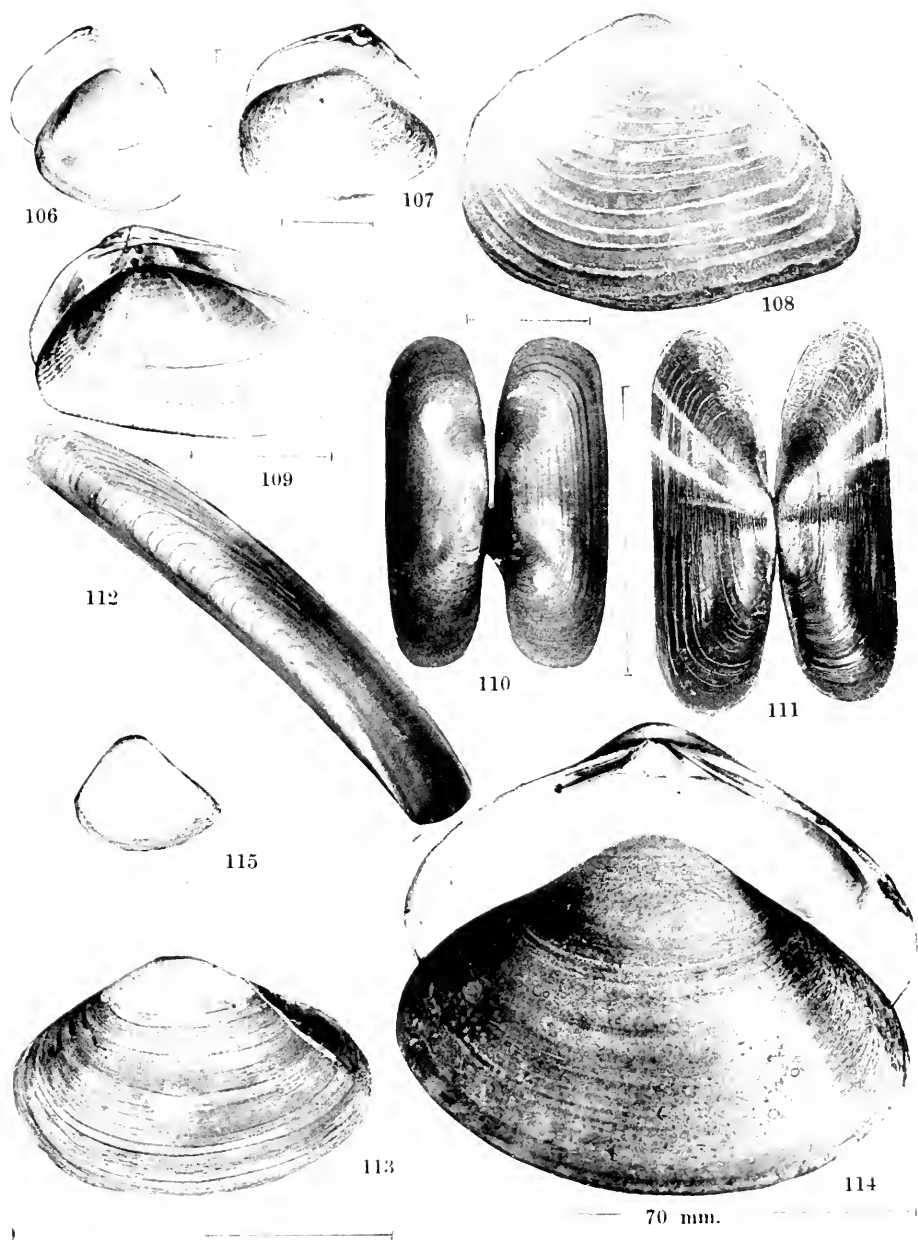


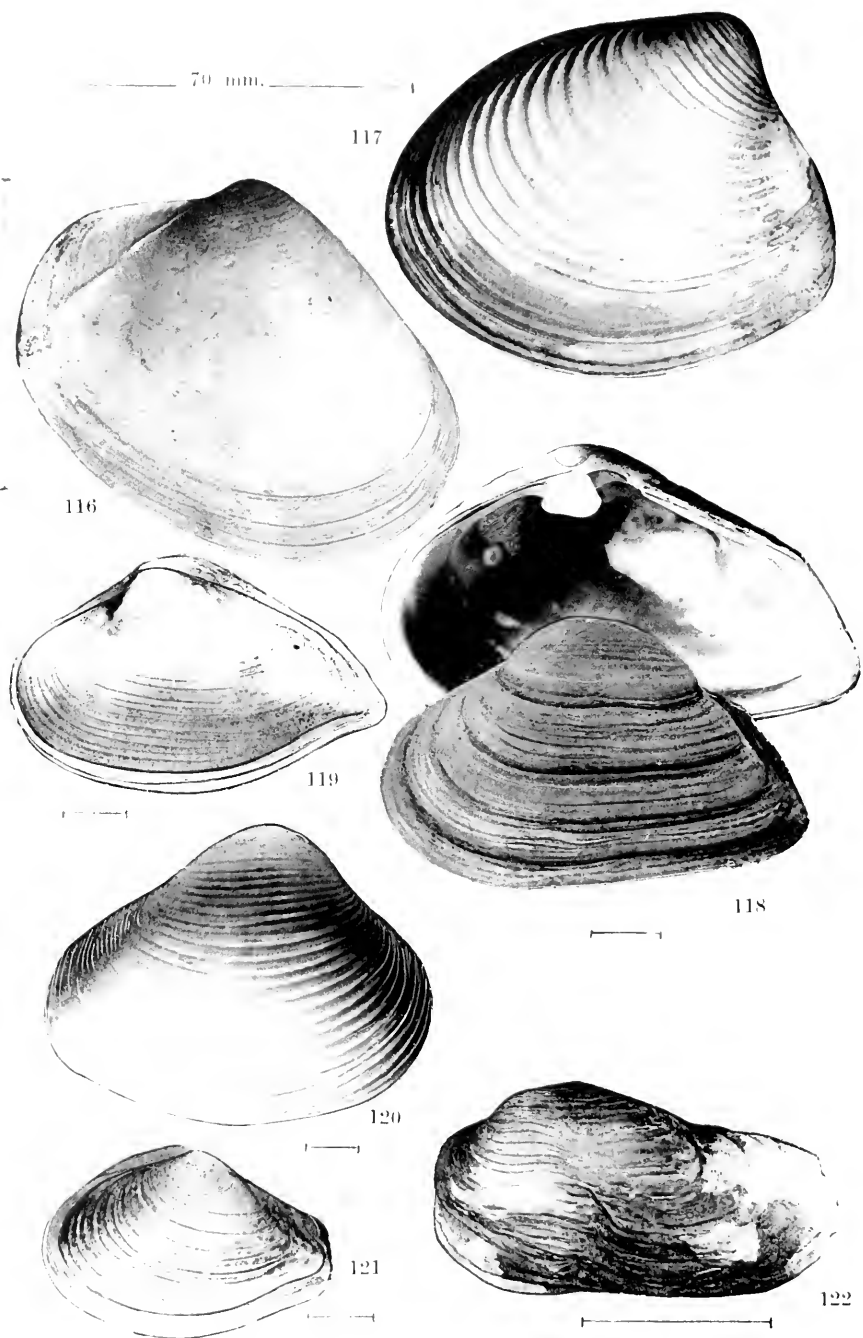
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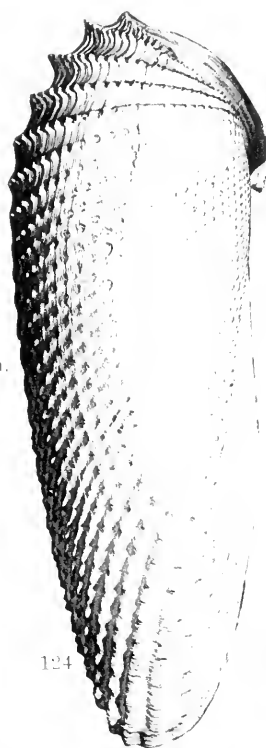


123a



123b

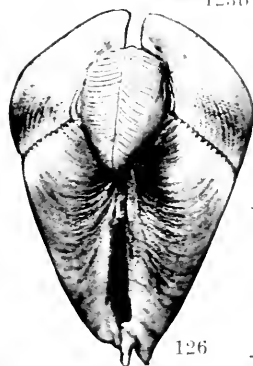
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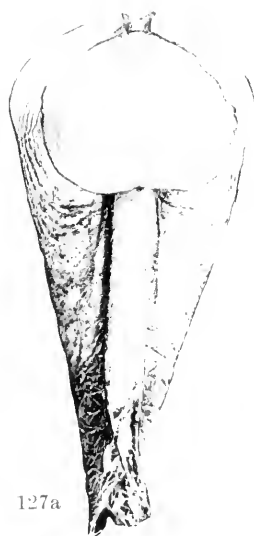
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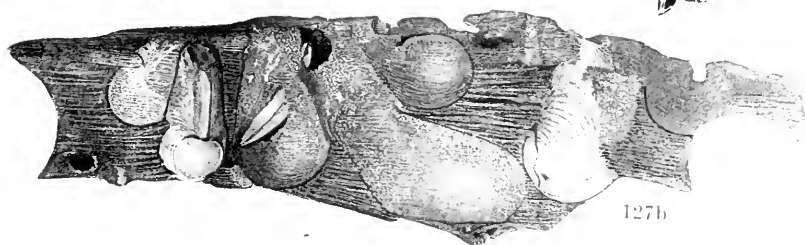
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127b





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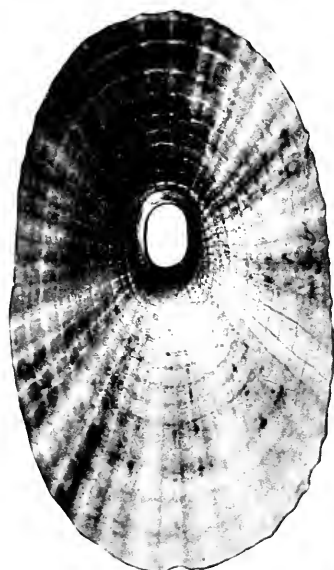
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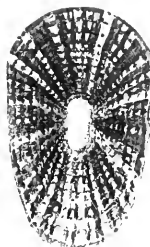
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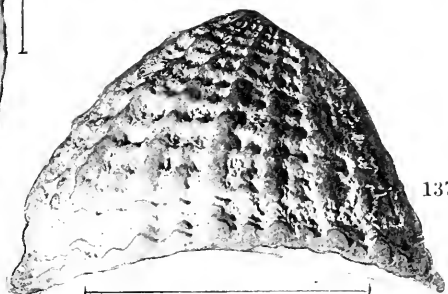
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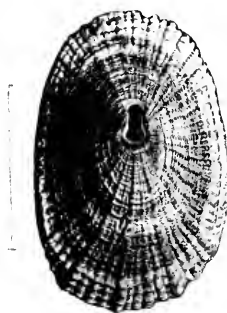
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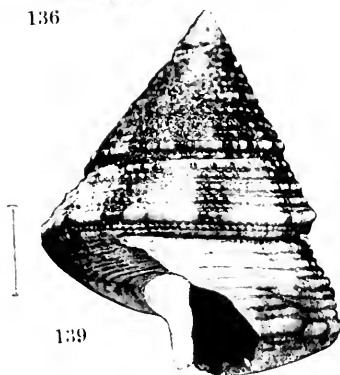
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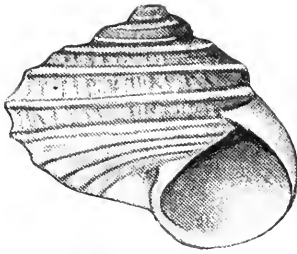
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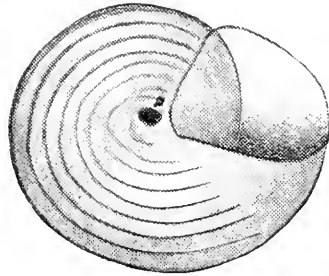
140b



140a



141a



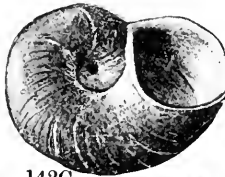
141b



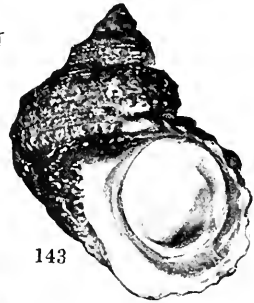
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142a



142c



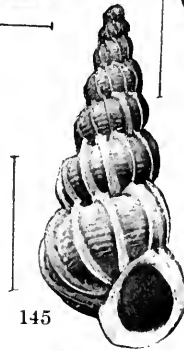
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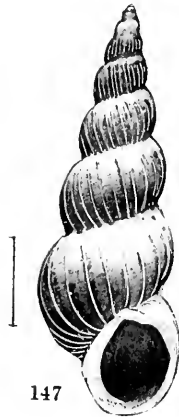
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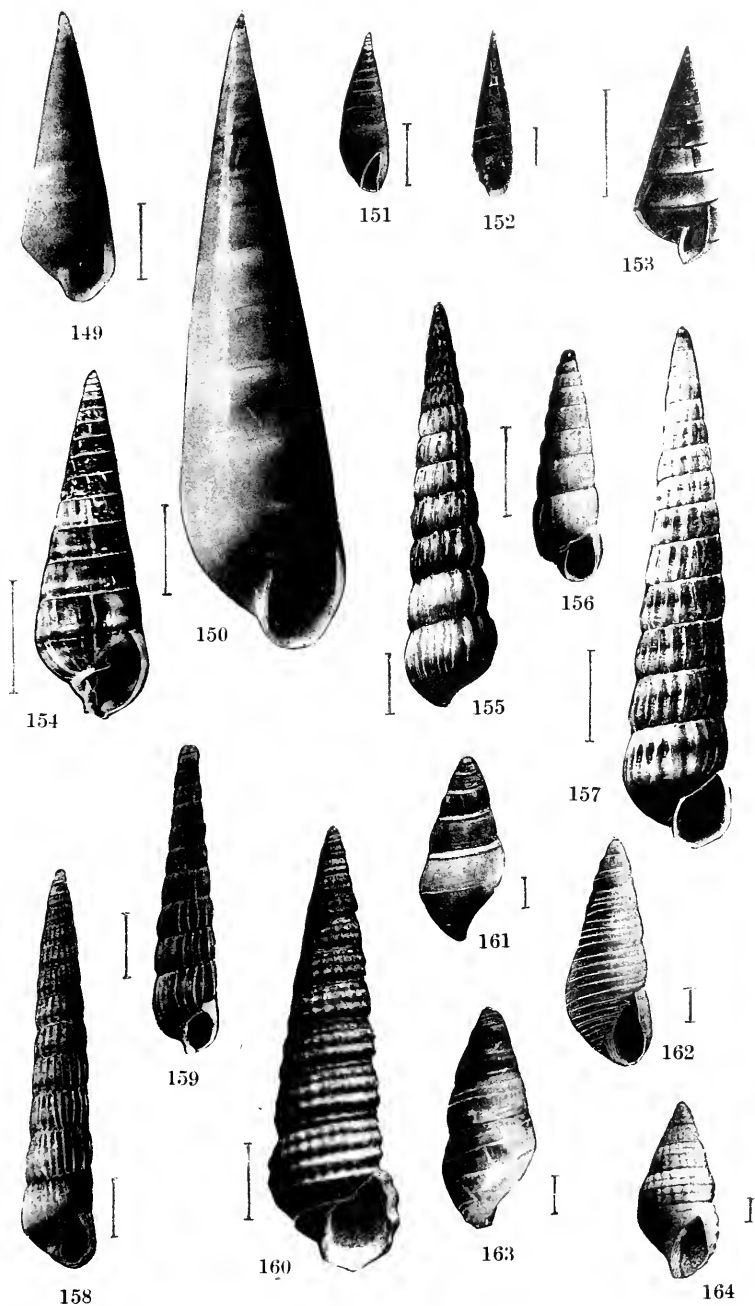
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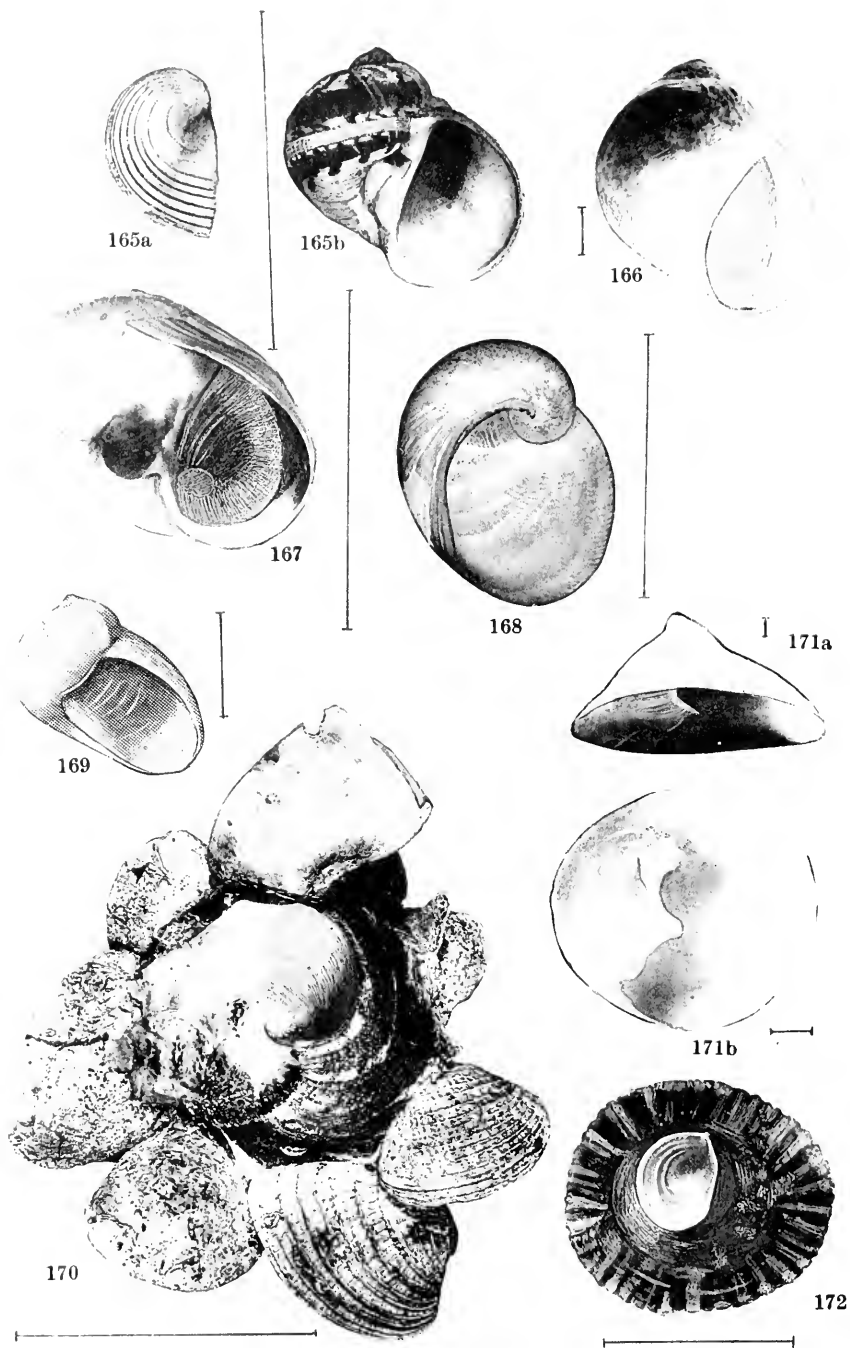
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\* Copy Pilsbry, Nautilus, 1939.

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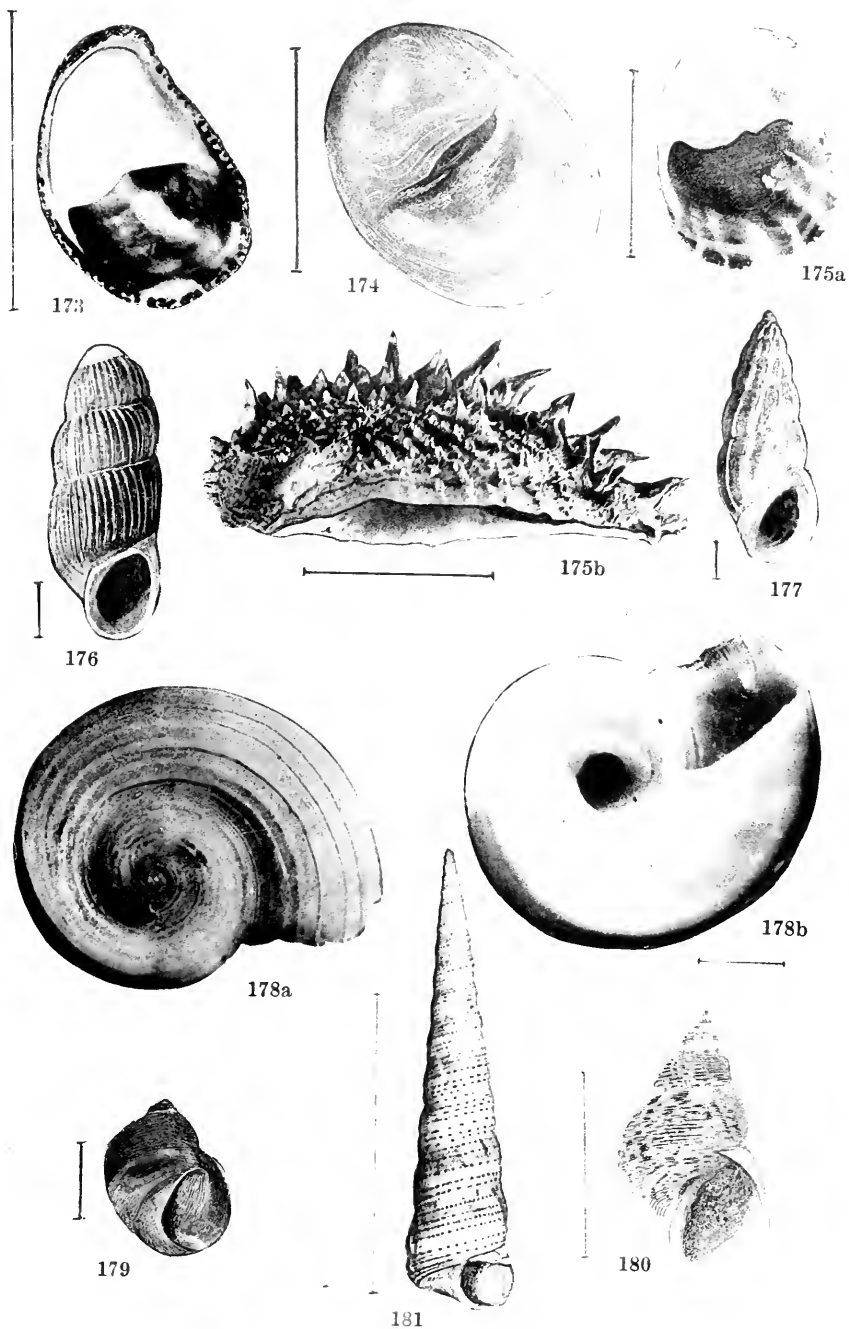


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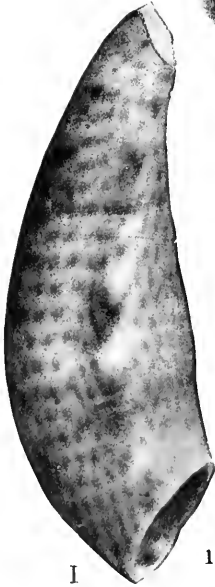


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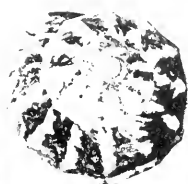
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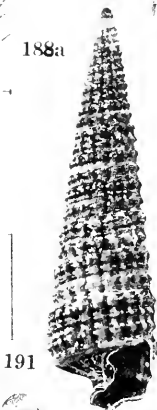
188b



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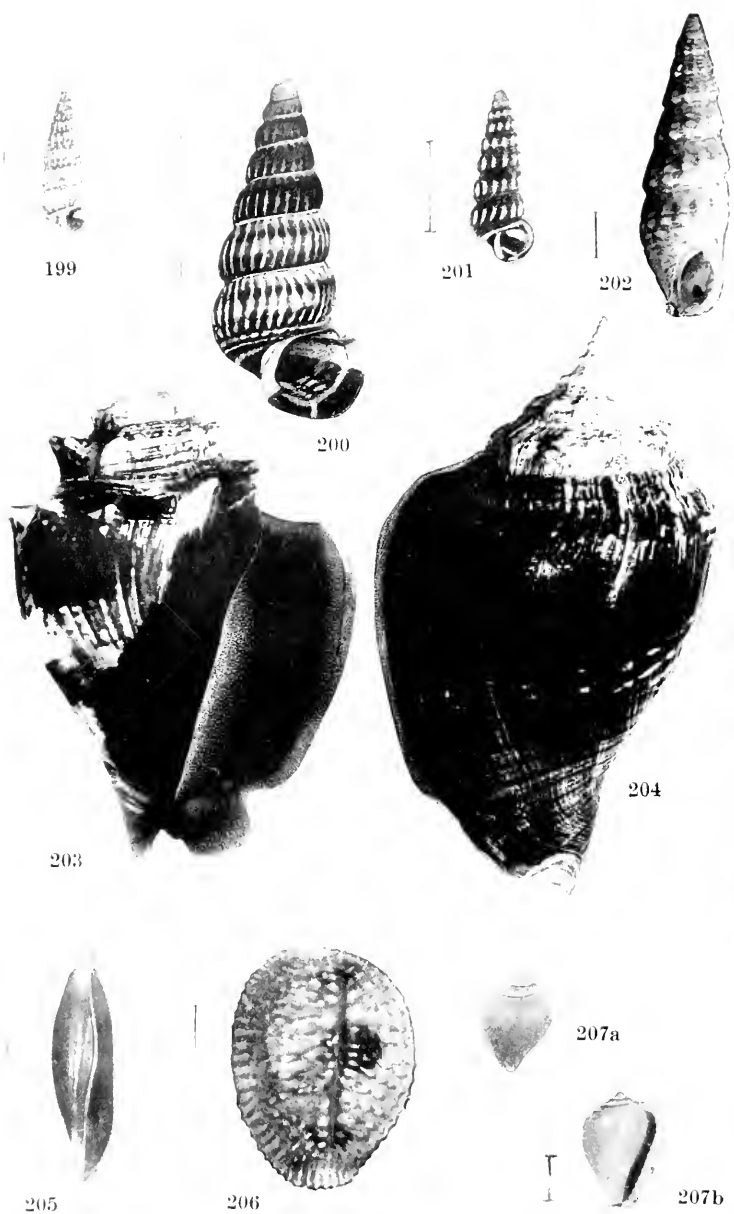
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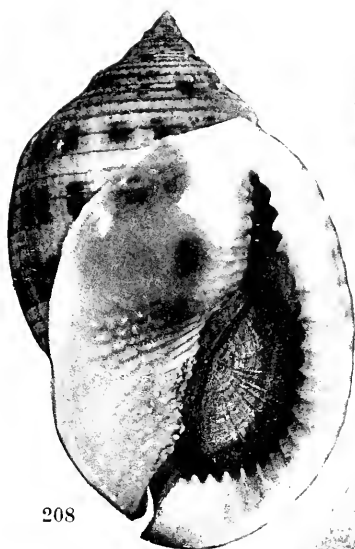


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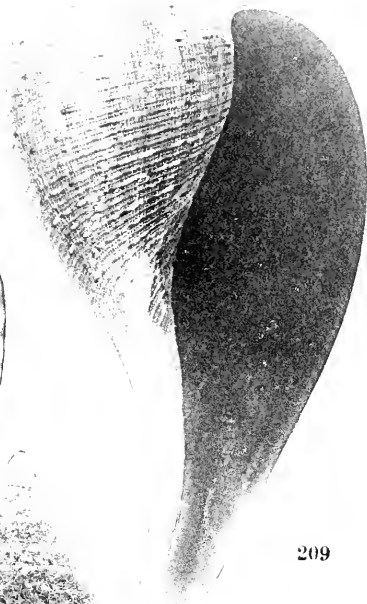
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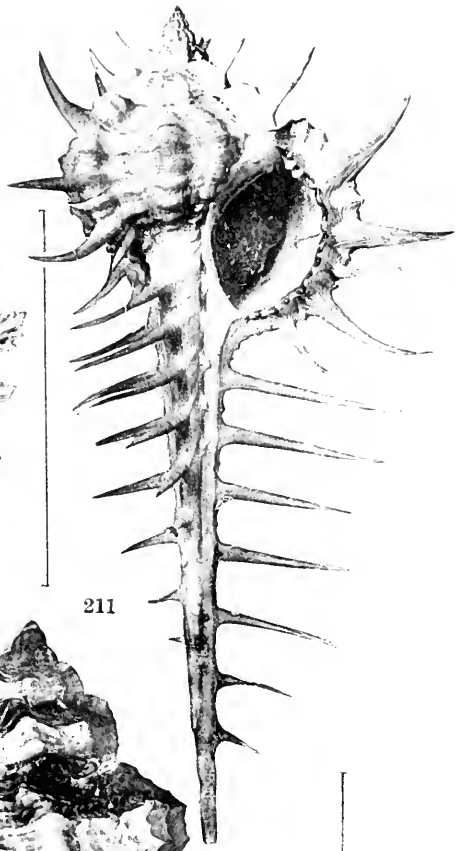
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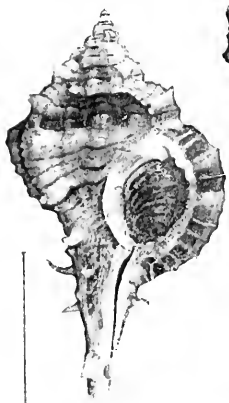
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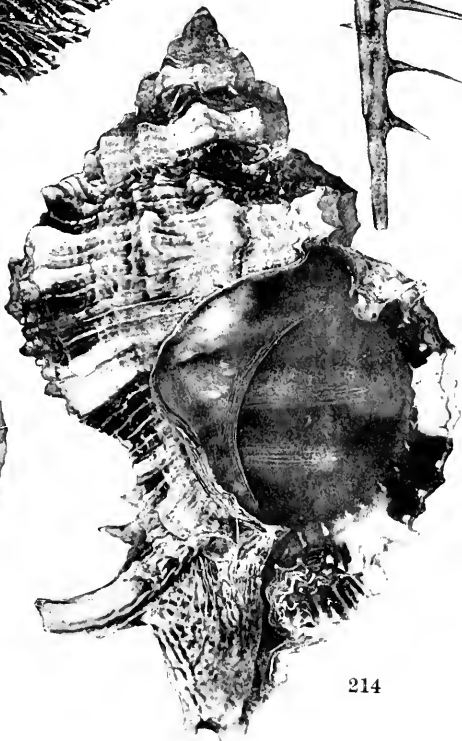
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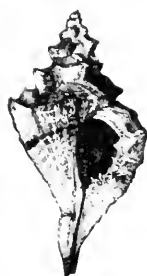
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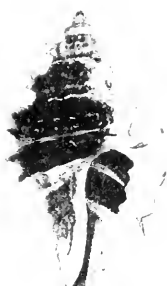
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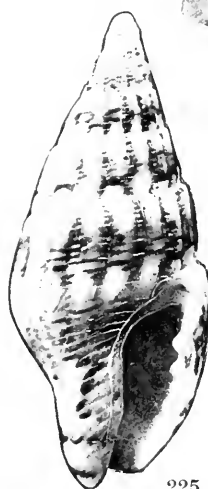
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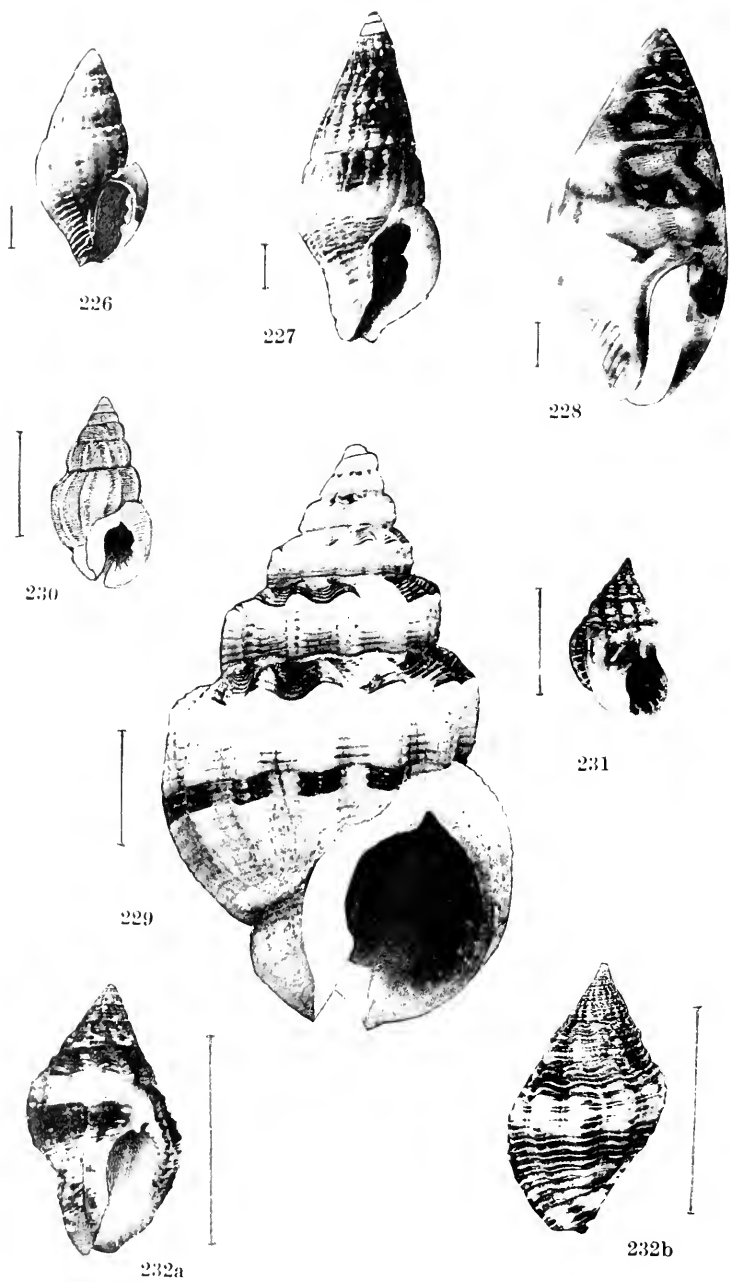
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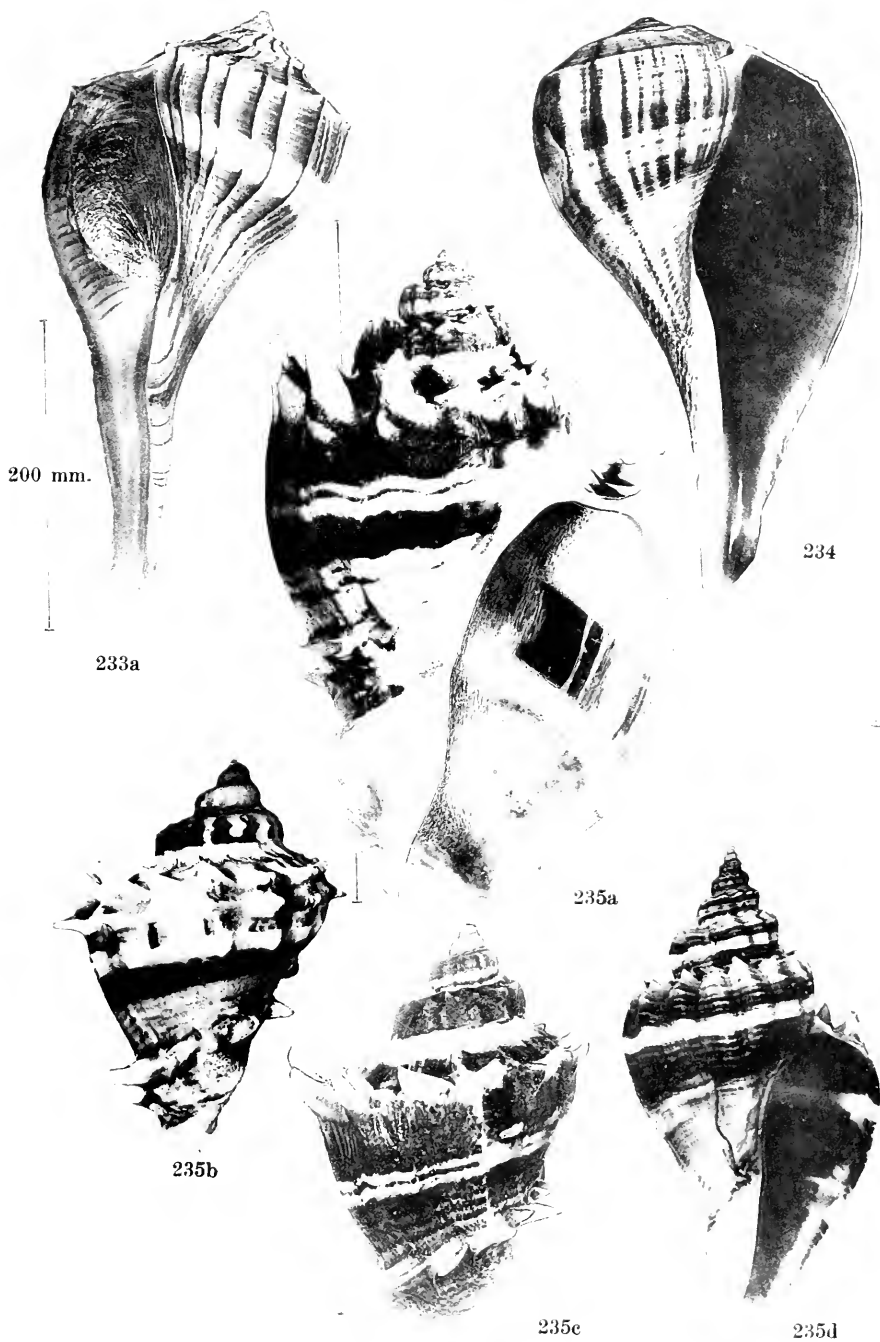
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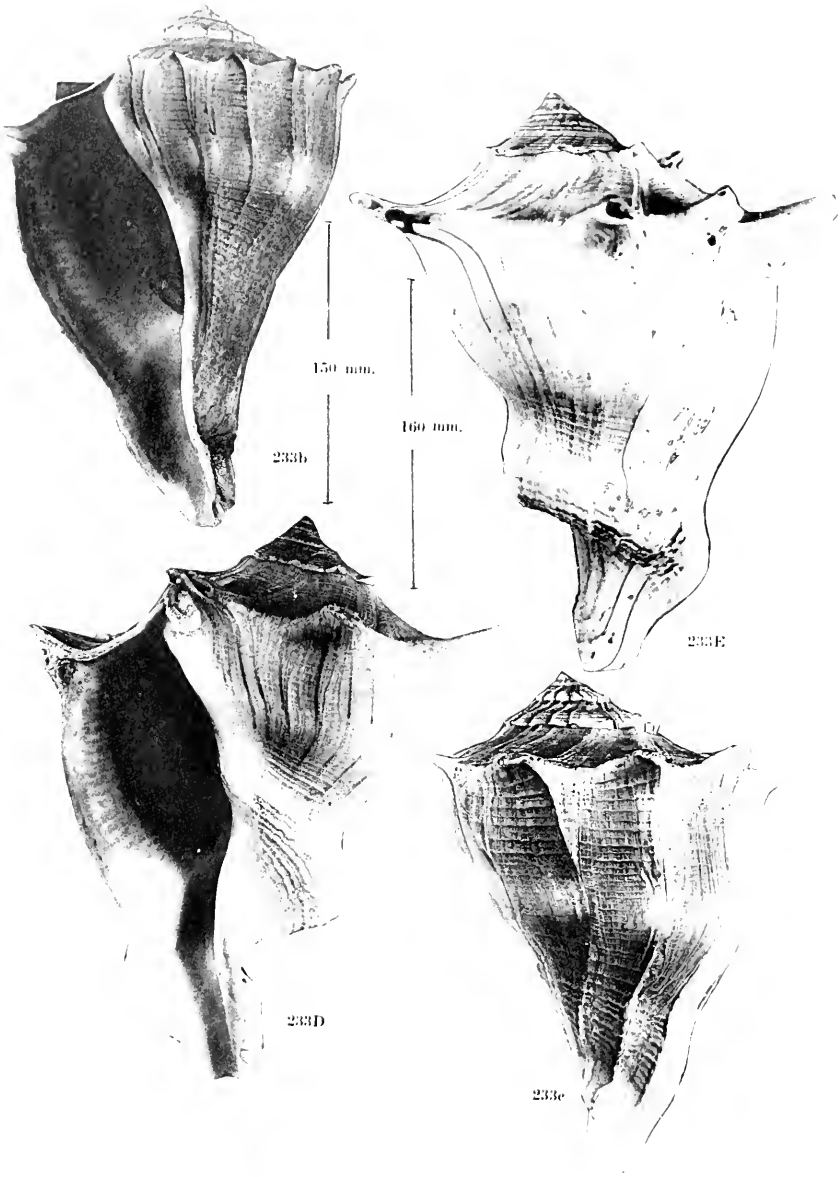
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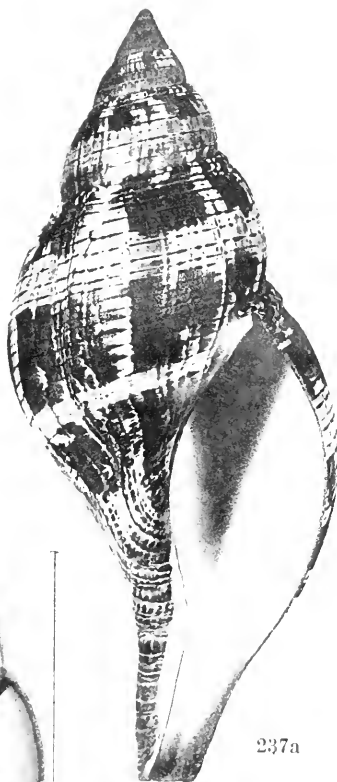
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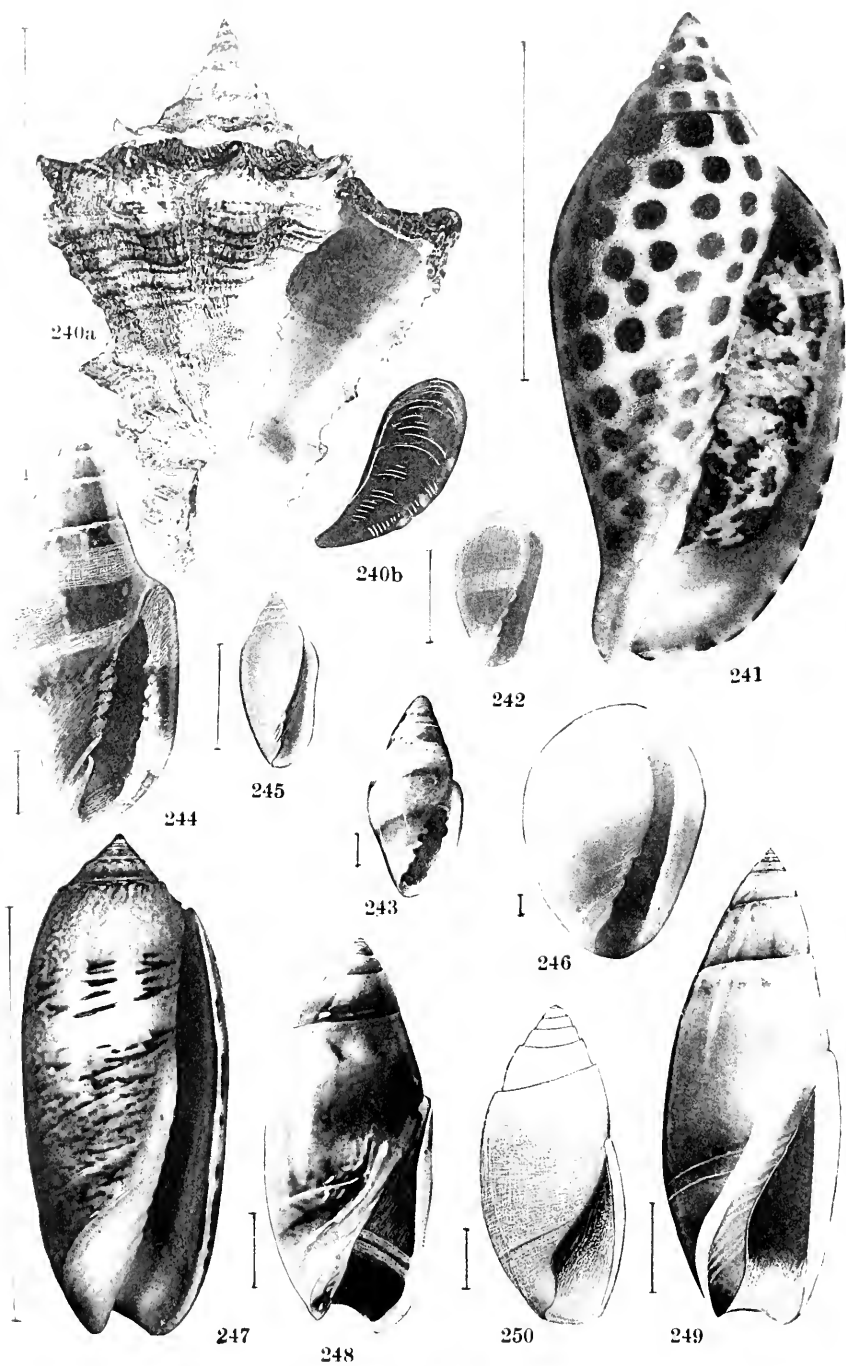
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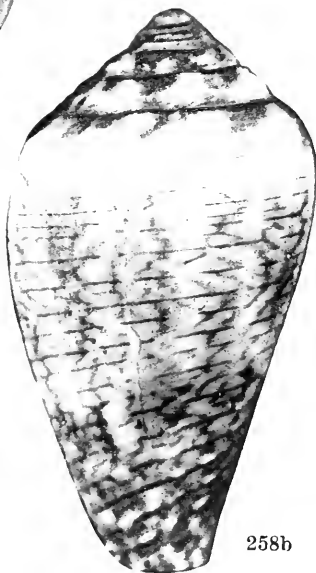
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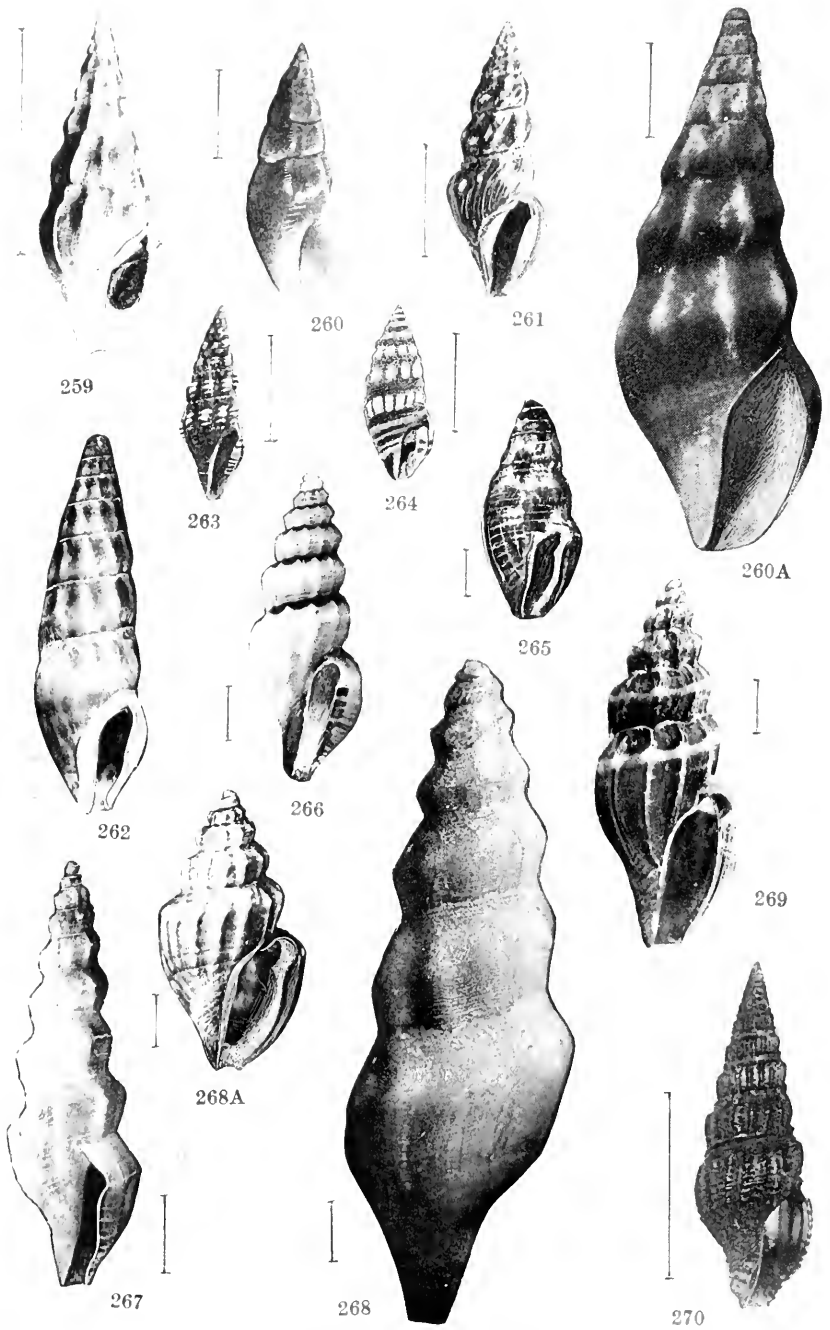
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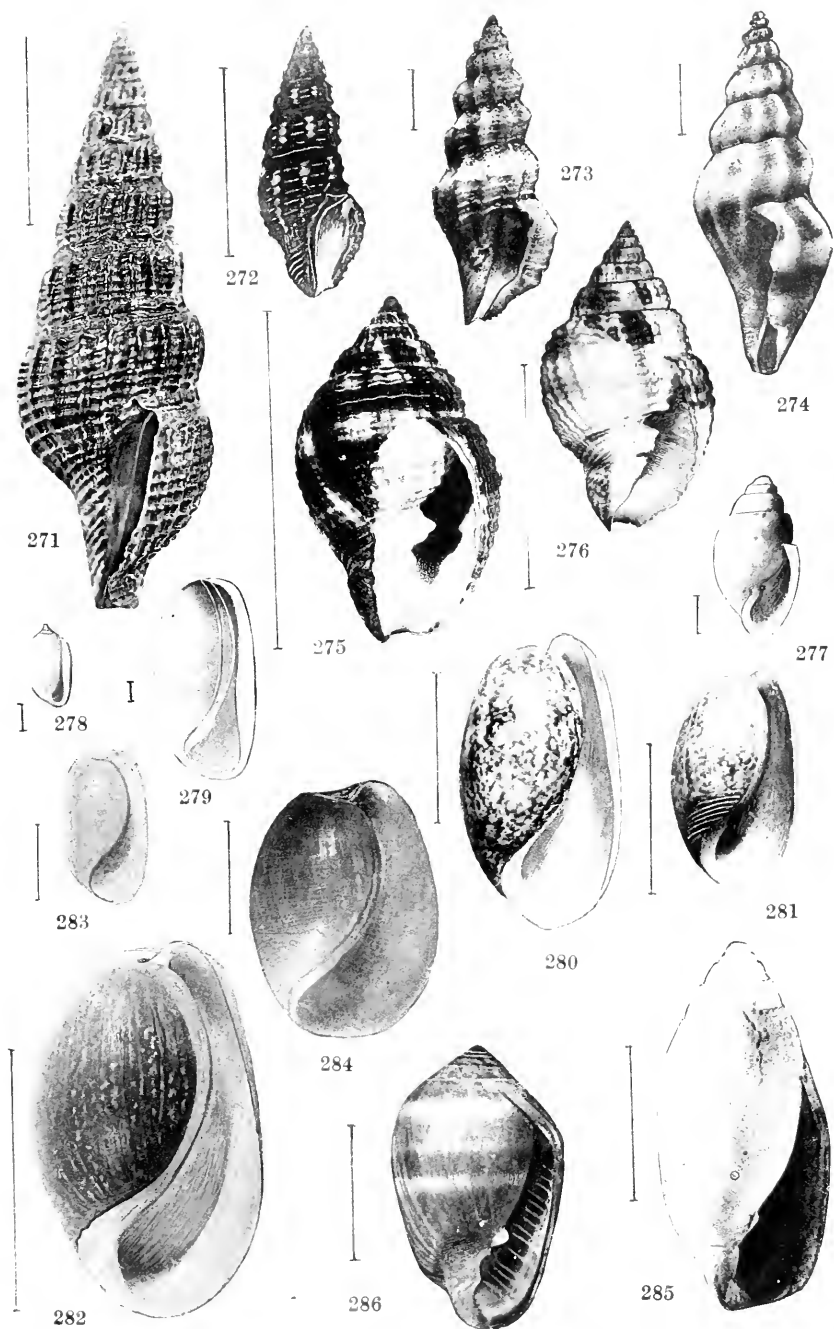


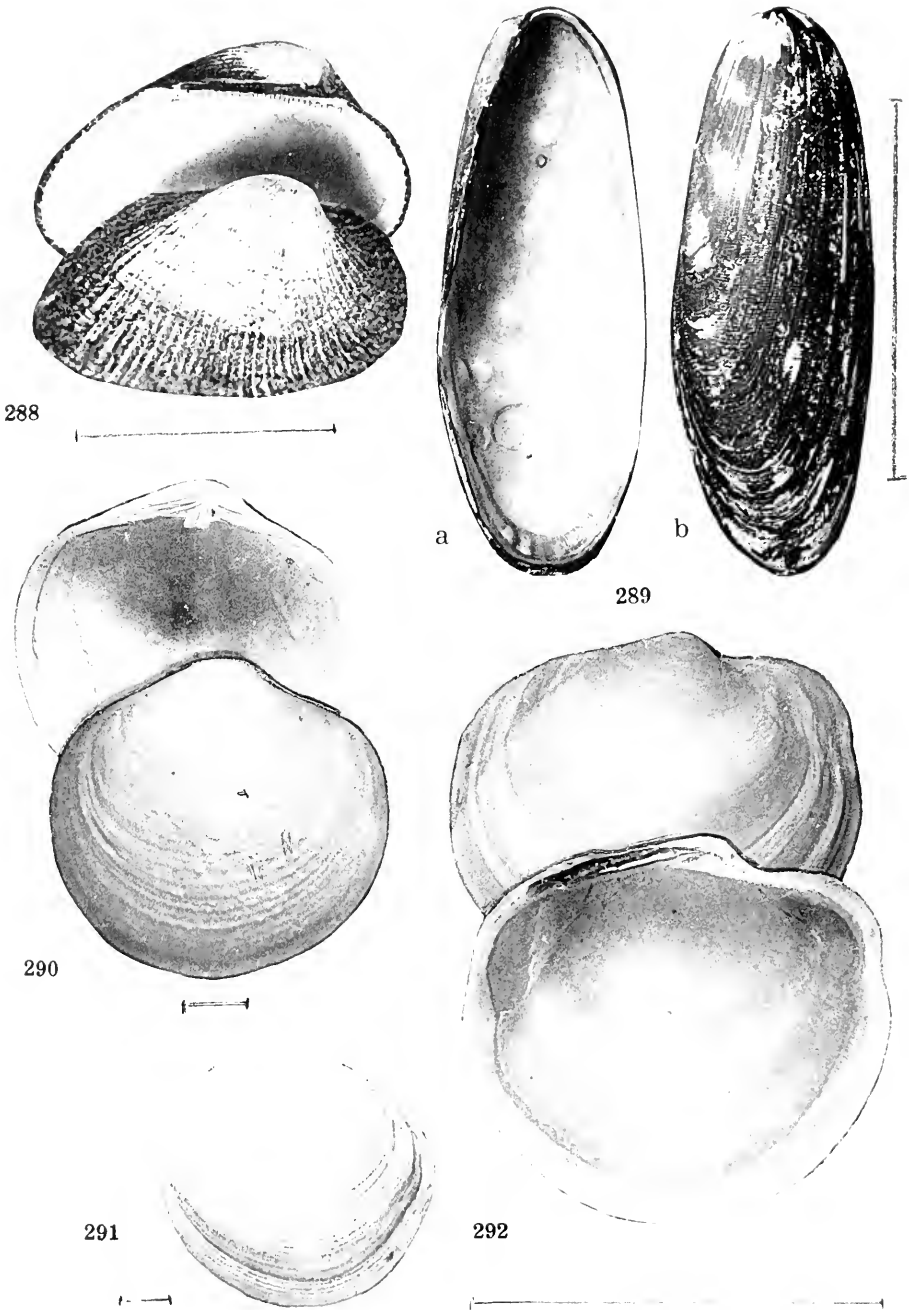
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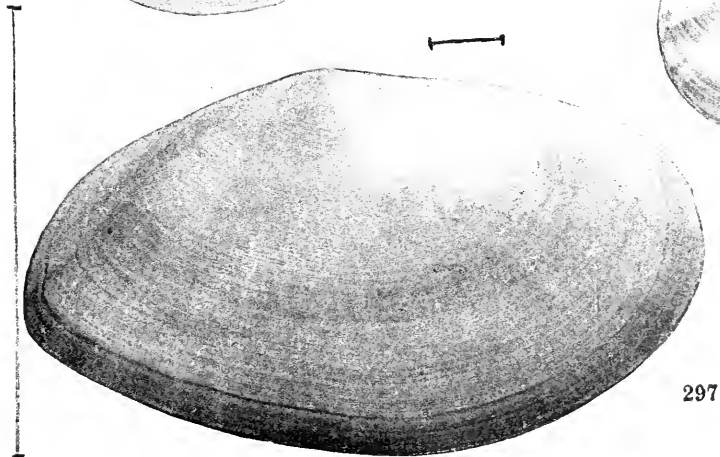
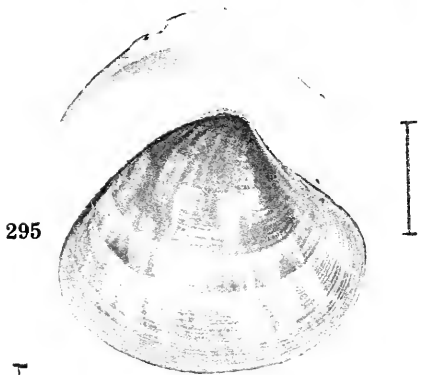
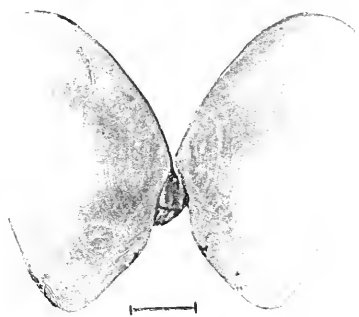
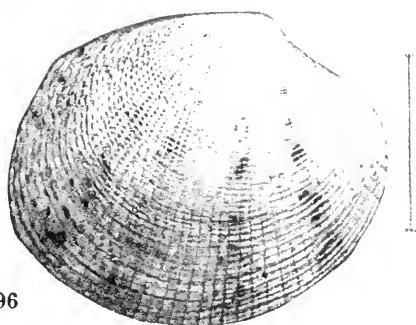


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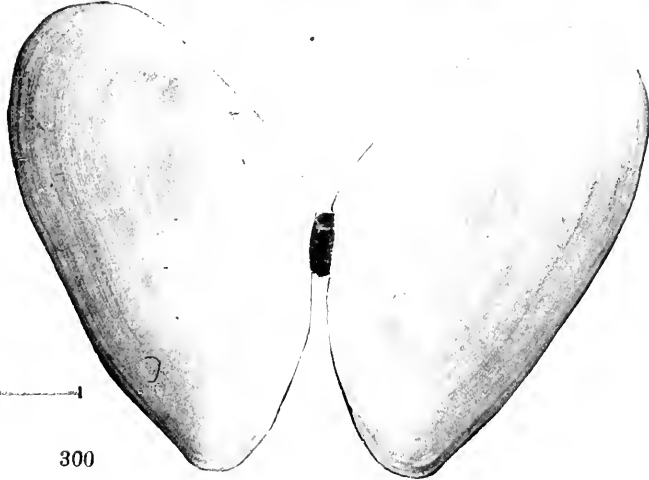




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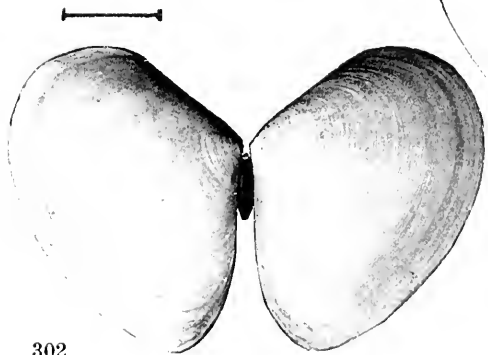
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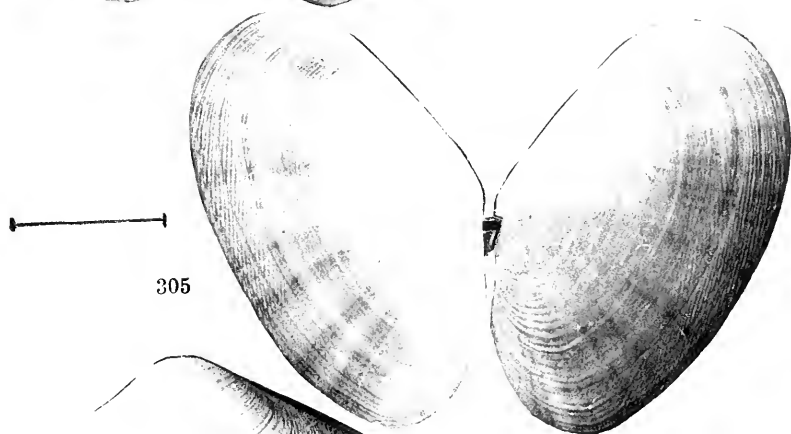
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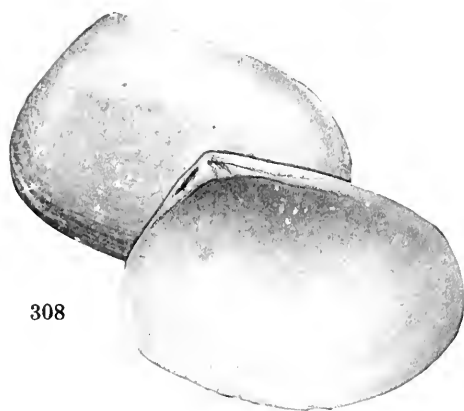
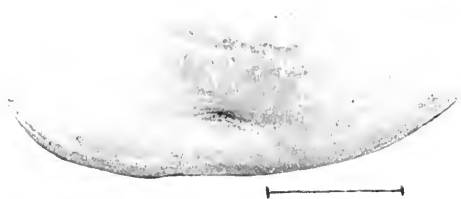
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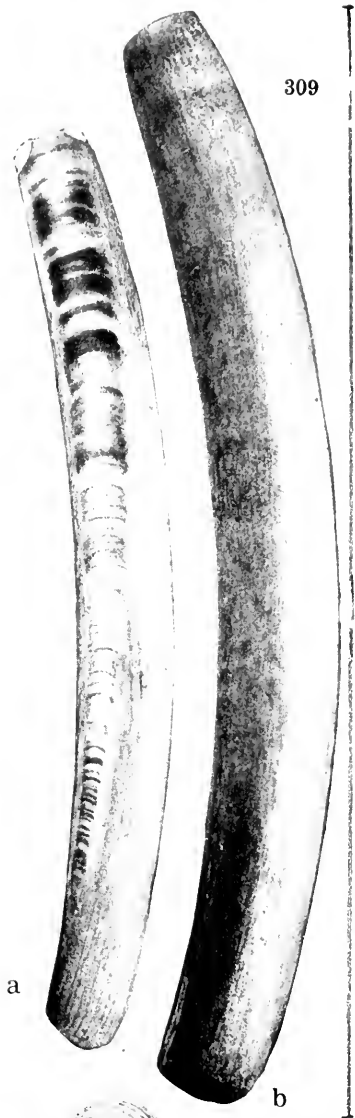
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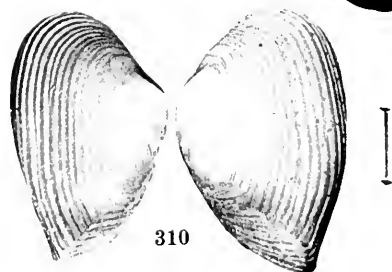
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\* The Nautilus, 57, No. 1, plate 6.

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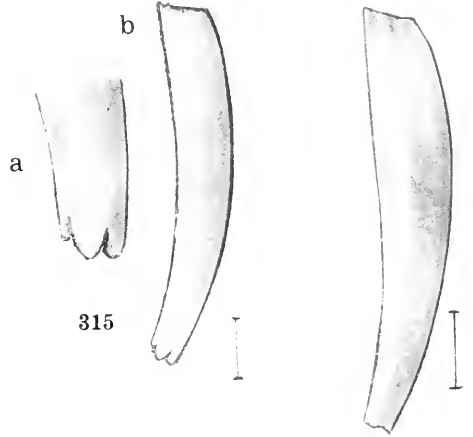
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\* Johnsonia, No. 19, plate 5.

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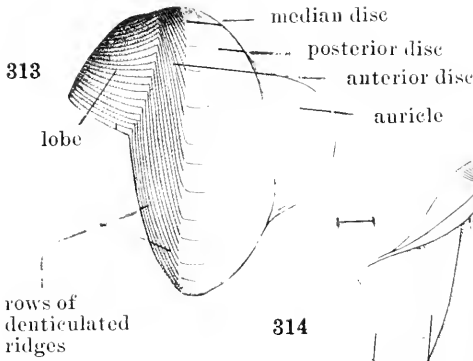


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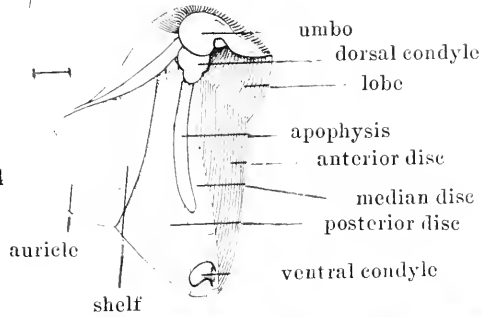
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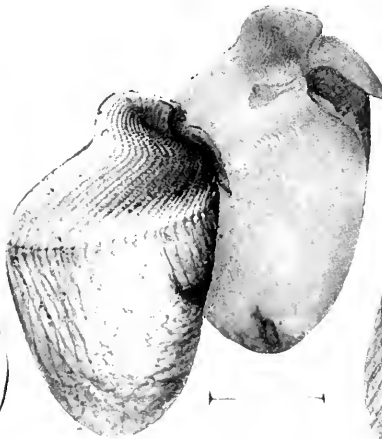


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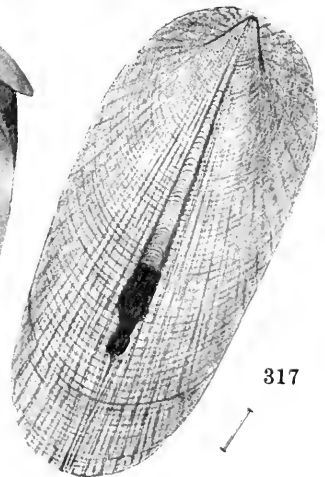
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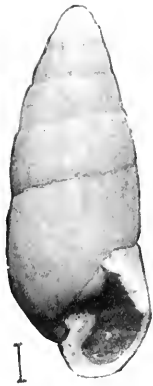
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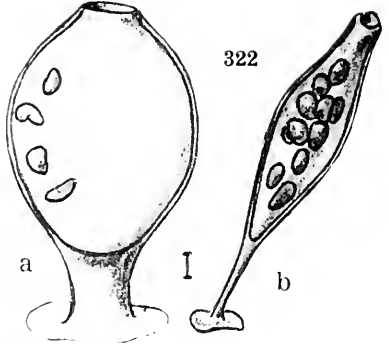
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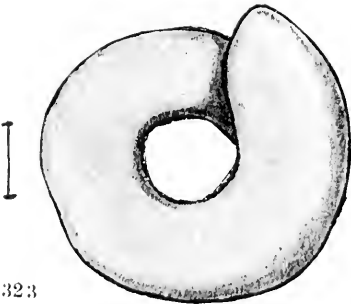
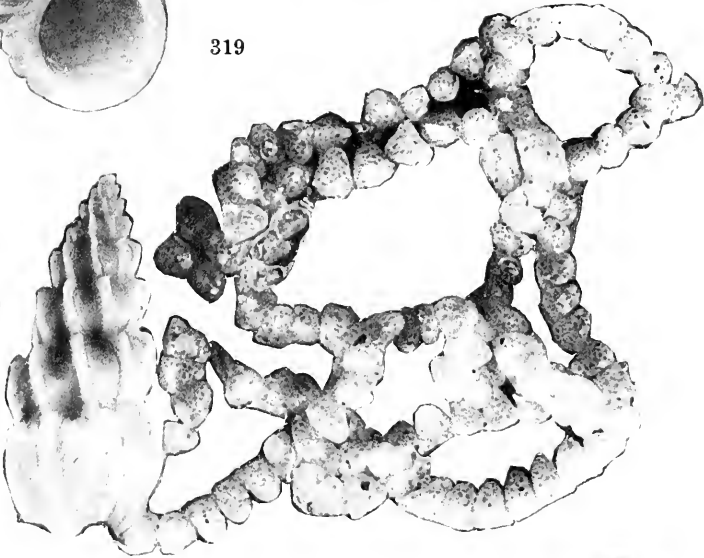
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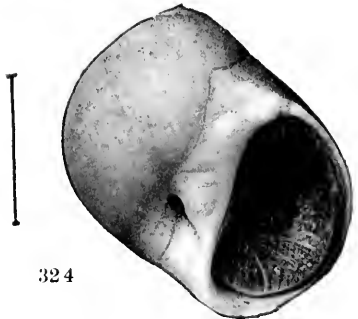
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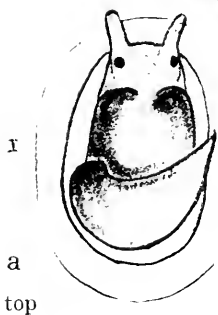
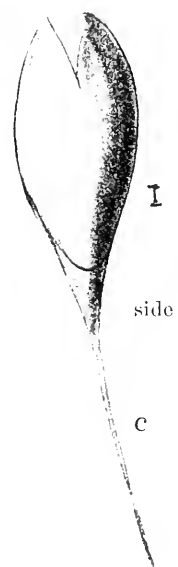
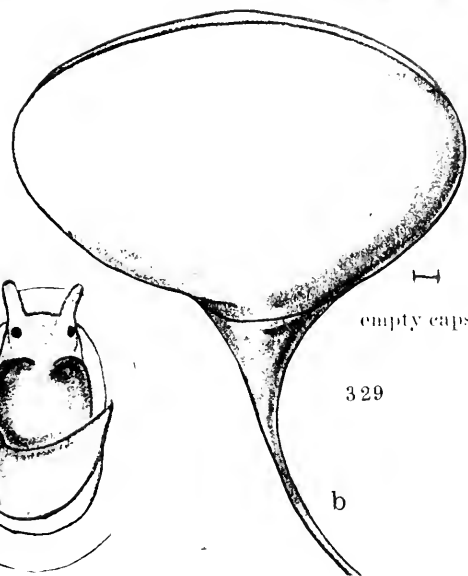
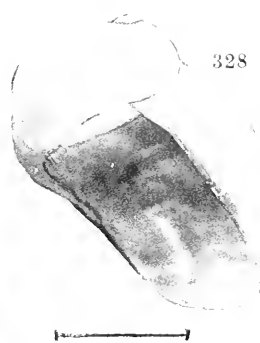
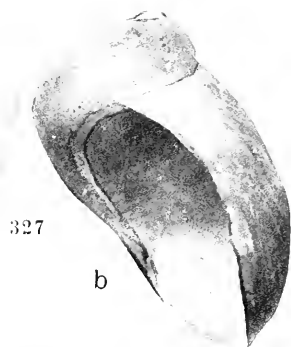
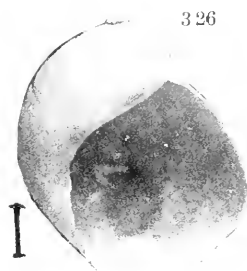
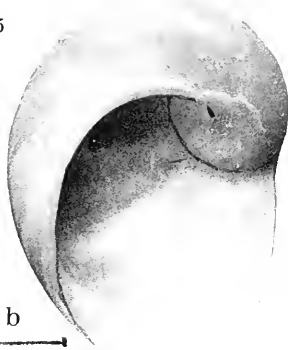
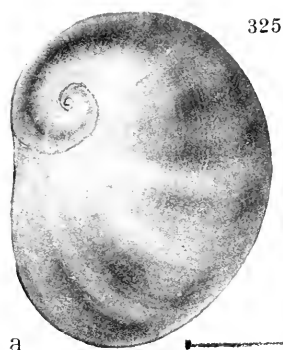
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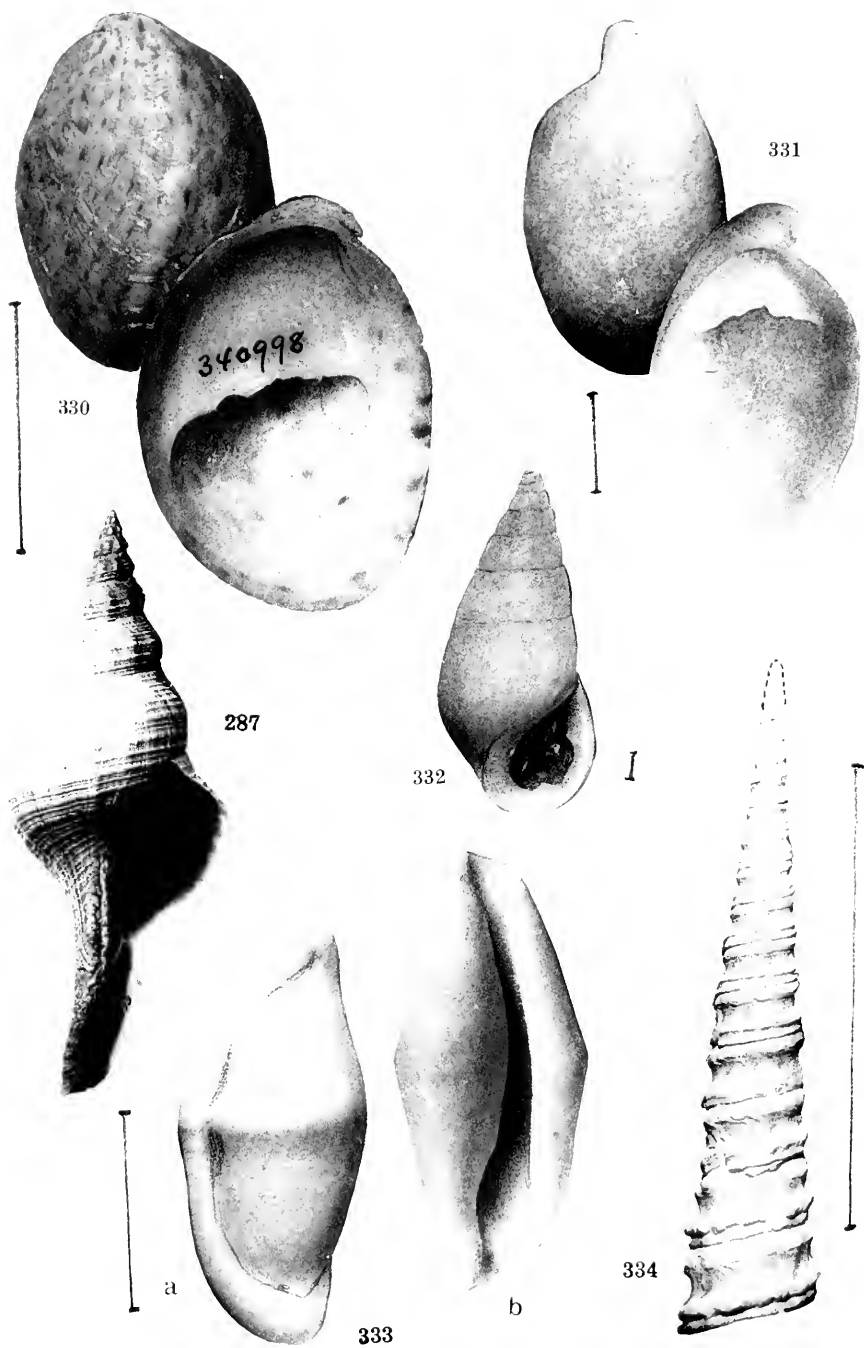
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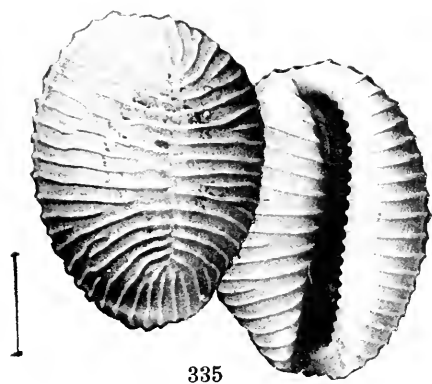
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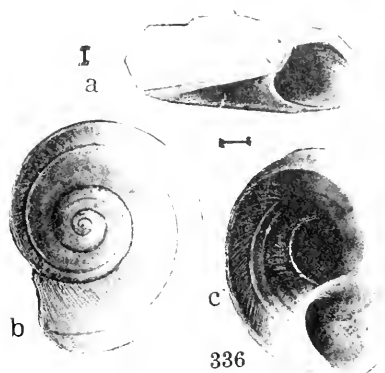
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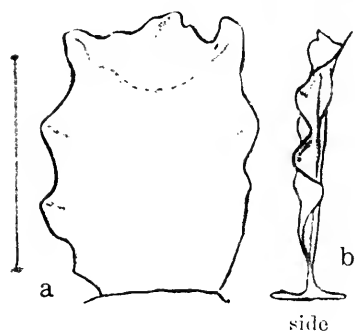
\* A.N.S.P. Monograph, No. 8, page 429, plate 55. After Dr. H. A. Pilsbry.



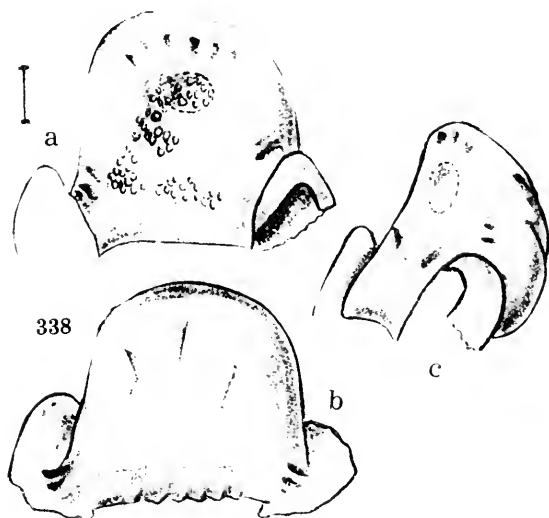
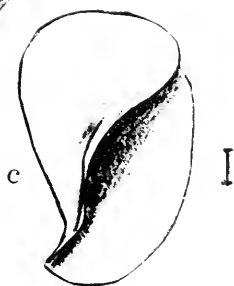
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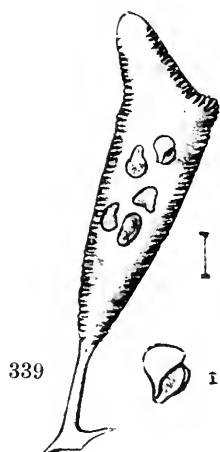
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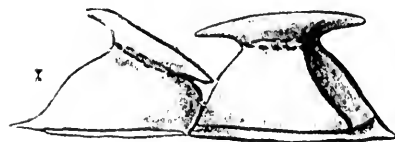
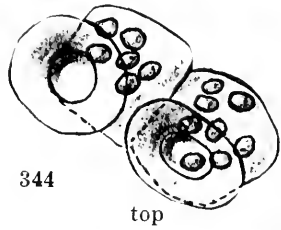
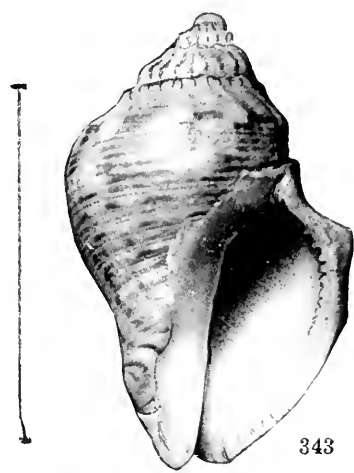
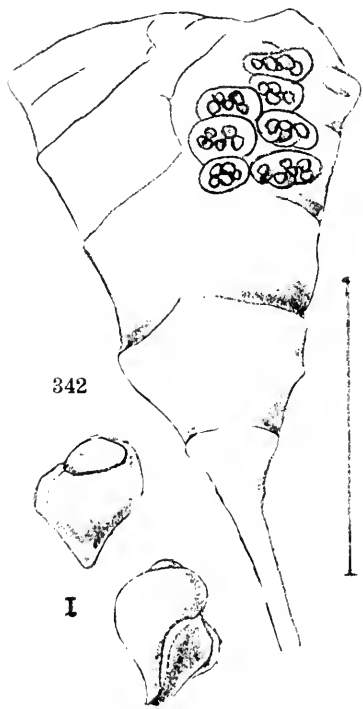
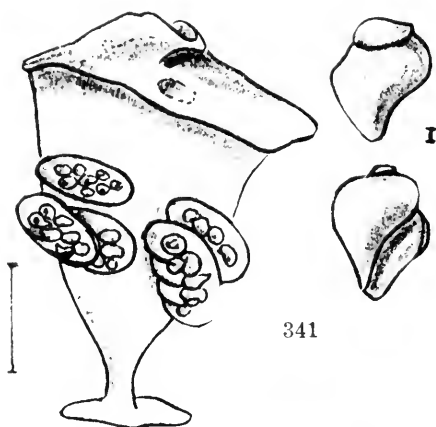
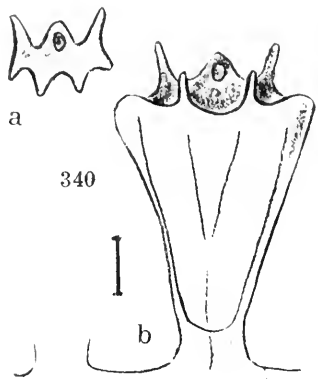
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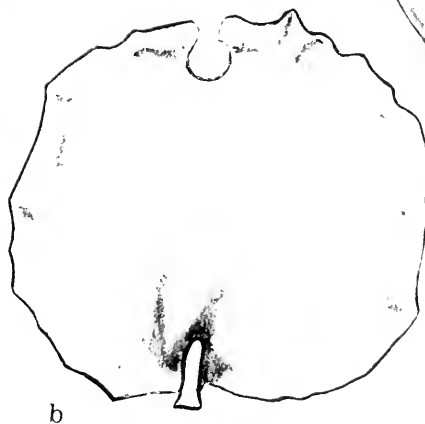
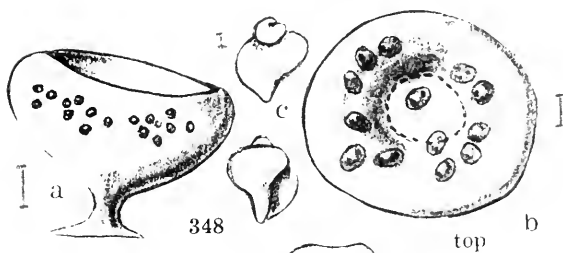
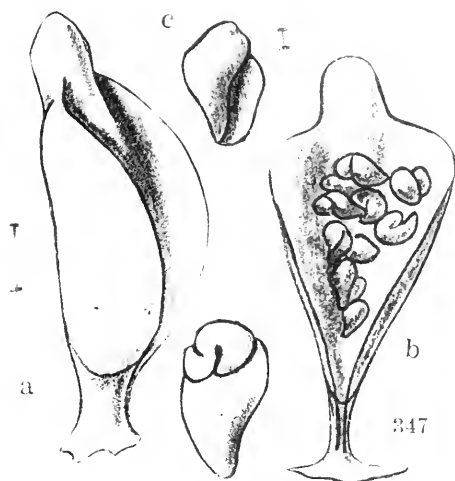
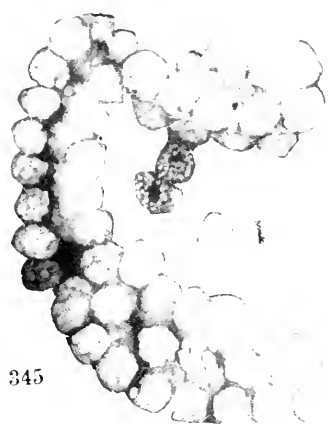
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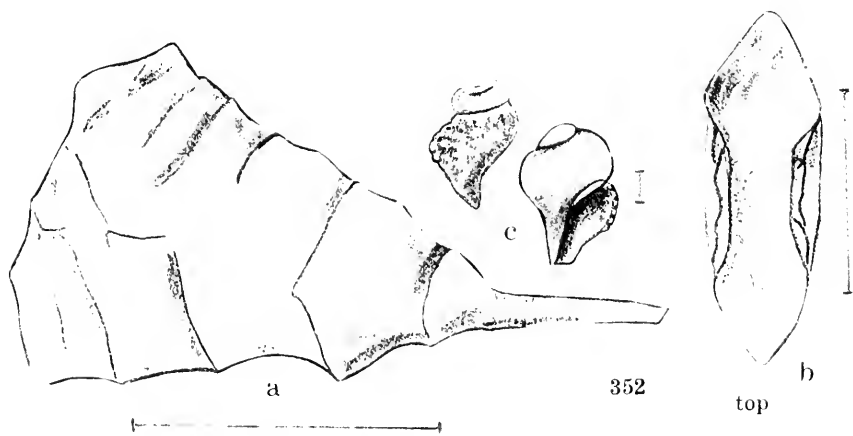
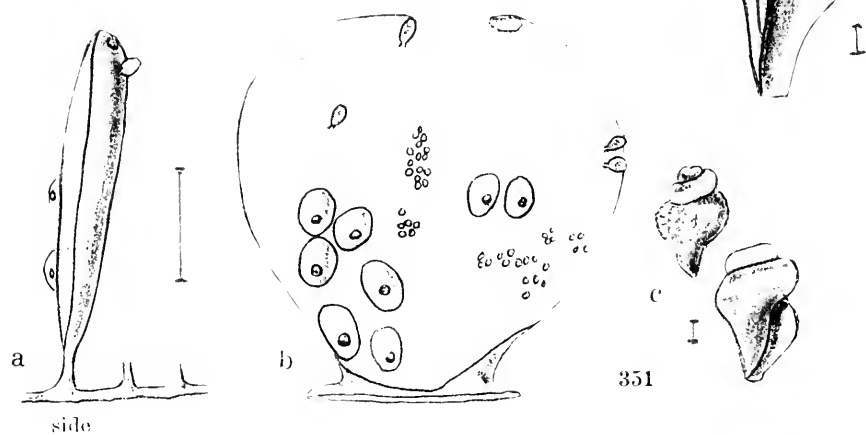
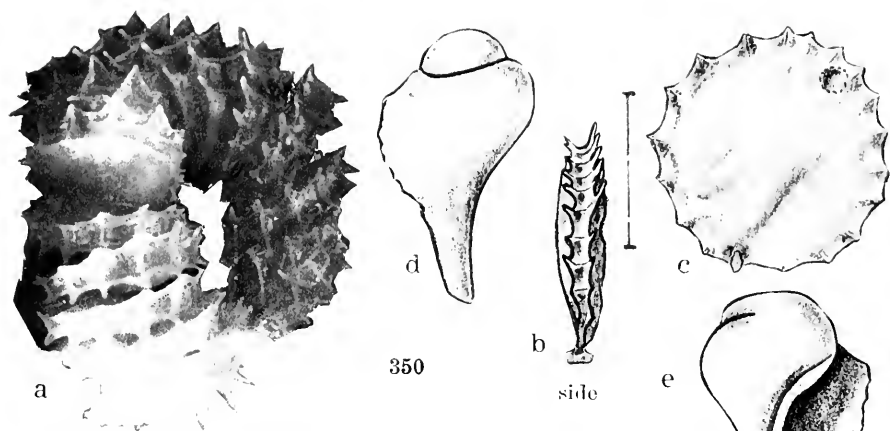
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\*\* On *Fasciolaria papillosa* Sowerby, egg capsule.

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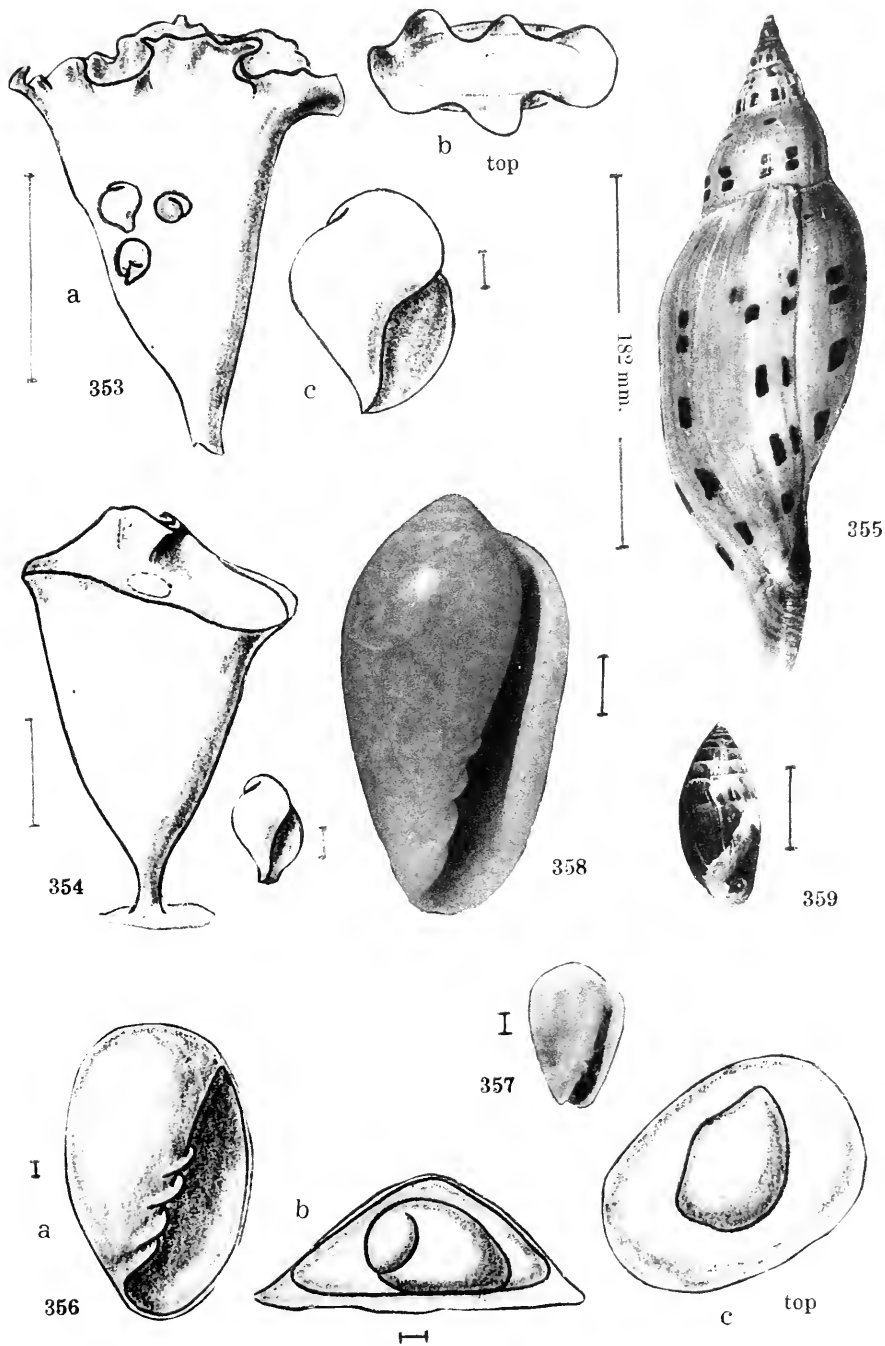
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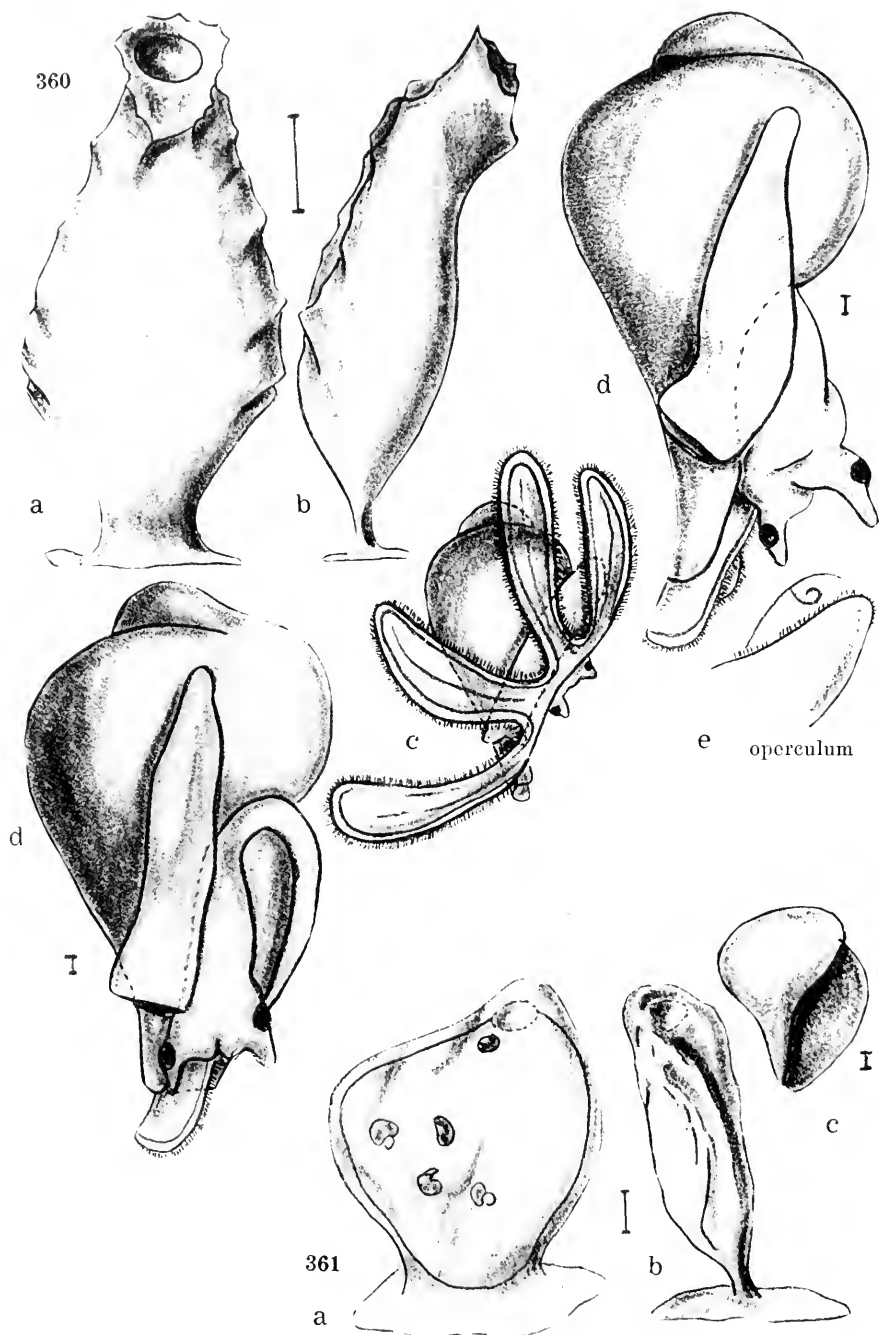
\* Egg capsules of *Marginella apicina* Menke and *Odostomia impressa* Say attached to egg capsule of *Melongena corona* (Gmelin).

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\* The Nautilus, 67, No. 1, plate 3.





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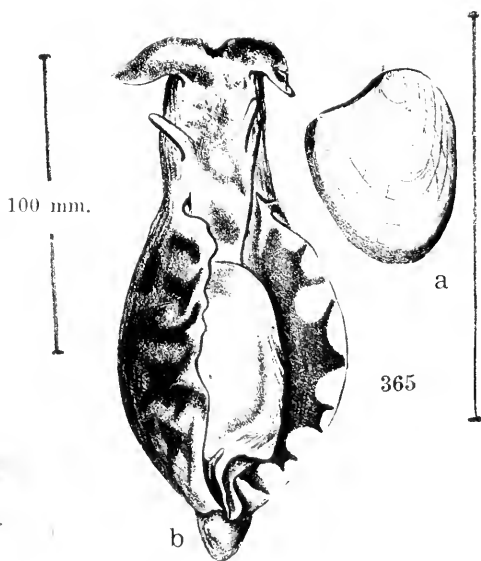
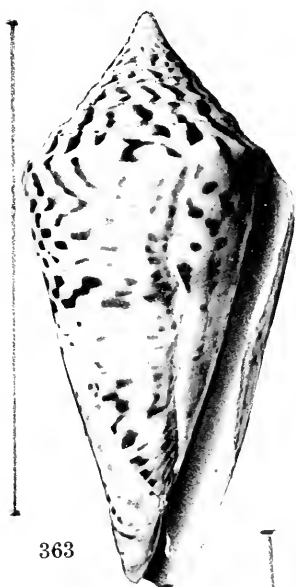
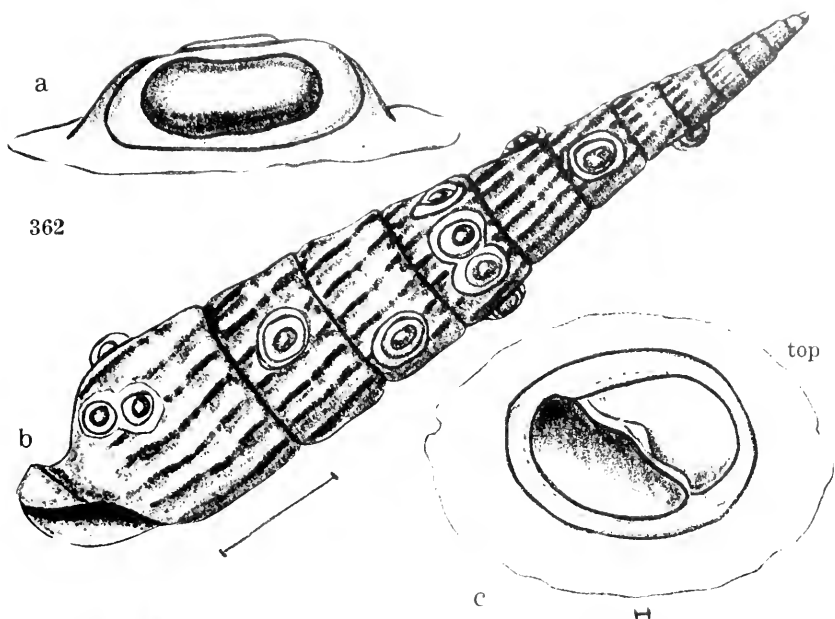
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\* Manual of Conchology, plate 35, figures 30 and 31.

\*\* The Nautilus, 55, No. 2, plate 3, figure 4.







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